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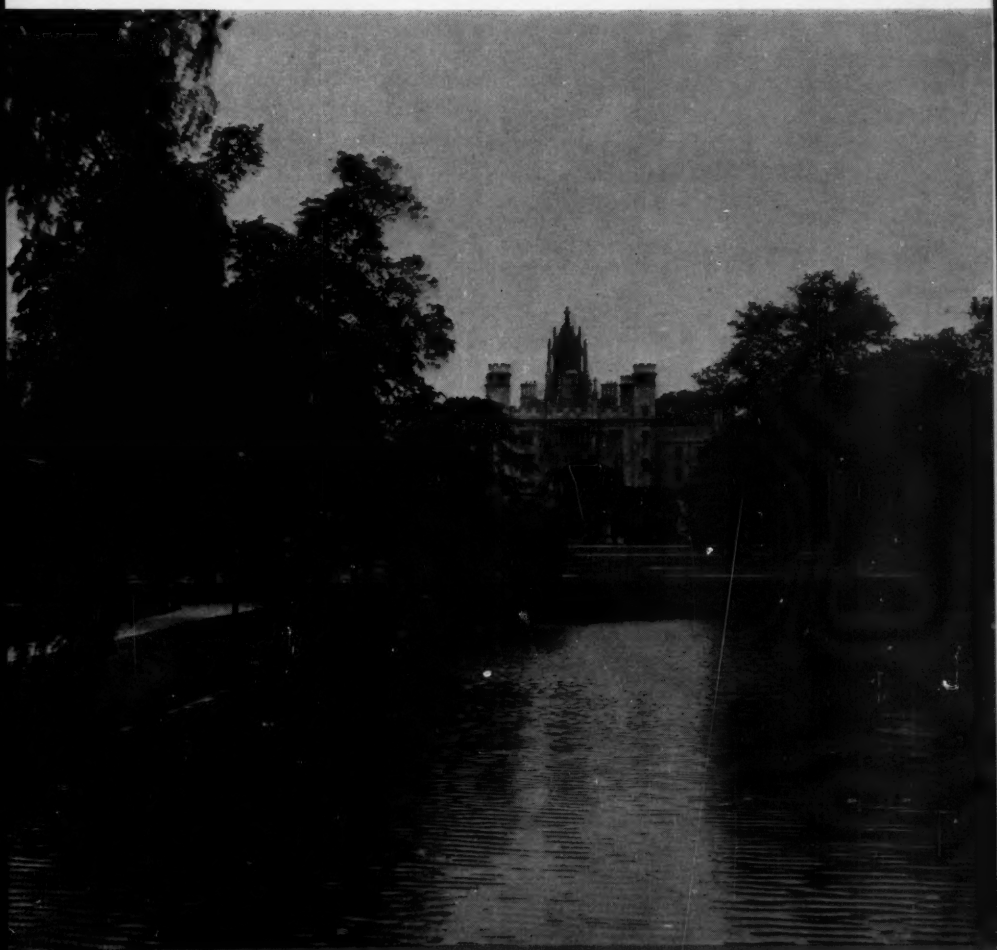

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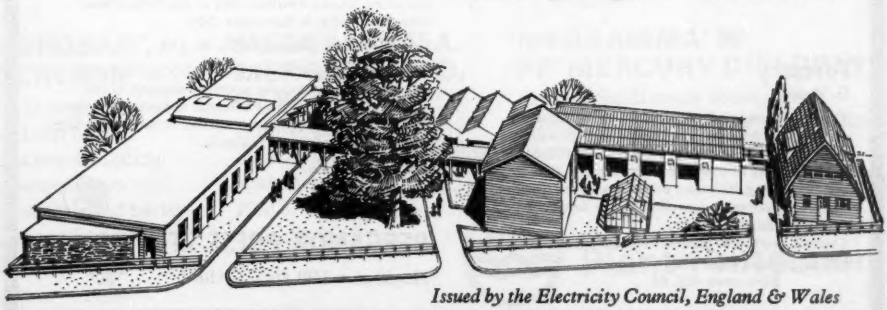

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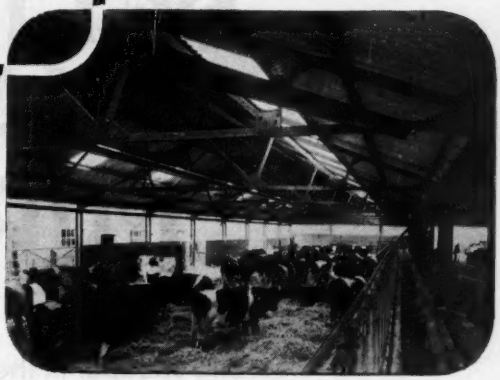

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Chemical Treatment for Cereal Seed

Loose smut, was the subject of a special article in *Agriculture*, November, 1966. This article gives up-to-date information about other seedborne diseases

P. D. Hewett

THE 'stinking-fish' smell of wheat grains destroyed by the bunt fungus is now a rarity in Britain—thanks to the effectiveness of seed treatment with organo-mercury compounds. Also rare, and for the same reason, are the similar ear-infecting diseases covered smut of barley and the oat smuts. As if to take their place, certain fungal pathogens causing poor seedling establishment and field failure seem to have increased. Fortunately the same chemicals proved of great value against these seedborne infections which, if not controlled by seed treatment, can cripple and kill germinating seedlings. Attacks are particularly severe when conditions in the seedbed are such as to slow down the speed of germination and early seedling development.

Oats

Regularly, although infrequently, oats are still reported as giving very poor stands in some parts of the country. Typically, the trouble has been traceable to diseased seed sown without fungicidal treatment. Both the leaf spot fungus, *Helminthosporium avenae*, and *Fusarium nivale* are involved, and are common on seed. *H. avenae* can be distinguished by the long, grey-brown stripes formed on the early leaves of seedlings that survive. No oats should be sown without treatment; there appears to be little to choose between the various proprietary powder and liquid treatments bearing the Agricultural Chemicals Approval Scheme label. But individuals applying powder treatment should not get carried away by enthusiasm and increase the rate of application or treat seed a second time—as this will not give better disease control and is likely to harm the germination capacity. These chemicals are poisons and, as when you use aspirin, there is a correct, safe dosage. Sometimes the use of the description 'dressed' is misleading since this may refer only to processing to improve the purity and appearance of the sample. For these diseases, and the others mentioned in this article, the 'look' of the sample is almost useless in deciding the extent to which it may be carrying diseases.

Wheat

Seedlings of wheat are also liable to attack by more than one seedborne fungus. *F. nivale* occurs fairly frequently on seed wheat but its importance in

the field has not yet been fully established. However, severe attacks are certainly one cause of thin and shrivelled grain, although this particular species of *Fusarium* has not been found to produce 'whiteheads'.

More common, on seed at any rate, is the fungus *Septoria nodorum* which is able to reduce stands by crippling the coleoptiles of developing seedlings although roots remain unharmed. It causes brown, elliptical leaf spots on the leaves, a yellow-brown sheath discoloration and glume blotch. Older leaf spots may contain minute fruiting bodies called pycnidia. When *S. nodorum* pycnidia are mature spores formed inside them exude as sticky orange-pink tendrils which are easily seen at 20 times magnification. The spread of the disease in the field is favoured by cool, damp conditions, which allow the infectious spores to germinate and penetrate the host plant. After summers in which suitable weather conditions have been frequent the levels of seed infection can be very high, particularly in winter wheat. Samples with seven out of every ten seeds bearing *S. nodorum* are not rare in such seasons.

A nation-wide survey, in 1963, of commercial samples received at the Official Seed Testing Station found *S. nodorum* infection abundant and widespread. Nearly all samples of the most commonly grown variety, Cappelle-Desprez, contained *S. nodorum*—the average seed infection reaching 7 per cent. In more recent years it has not been difficult to find severely-infected samples of wheat in certain areas. Regional weather conditions have a great influence on both the amount of leaf damage which develops and on the eventual levels of seed infection. Seed from the south and west has several times more infection than seed from the more traditional seed-producing areas in the east of England.

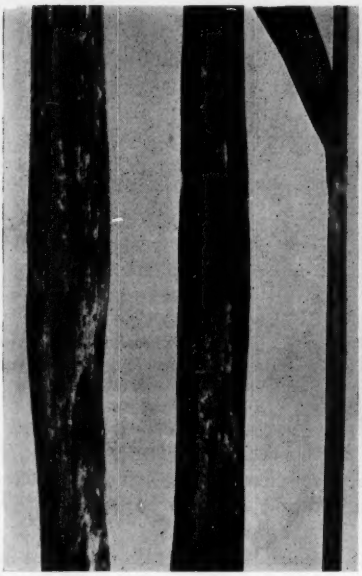
Treatment

The seedling phase of attack by both *S. nodorum* and *F. nivale* is adequately controlled by seed treatment with organo-mercury compounds. We know very little about the later phases of attack, but seed treatment alone appears to have very little effect. Possibly the small numbers of diseased seedlings which develop despite seed treatment are sufficient to start the later field attacks. But stubble—on which *S. nodorum* can be abundant throughout the winter and spring—may be a more important source of the spores which continue the cycle of infection.

After severe attack by *S. nodorum* considerable numbers of thin and shrivelled grains are evident, and the occasional infected seed may show a brown, wrinkled patch on its dorsal surface. Yield losses of 5–40 per cent have been estimated abroad but there are no published figures for this country. Epidemic attacks are obvious, but in most years the disease may be causing losses which are relatively small and therefore disregarded by the farmer. Small losses are difficult to assess and thus tend to be neglected by plant pathologists also, but such chronic infection could well be causing quite considerable overall loss—certainly in those areas where weather conditions favour the fungus.

Barley

In recent years the value of seed treatment for barley has often been queried since this crop seems to be free from establishment mishaps. However, the expense of treatment is justifiable as an insurance against future trouble. *Fusarium nivale*, which has been mentioned as a pathogen of oats and wheat,



Leaf and sheath lesions caused by Septoria nodorum

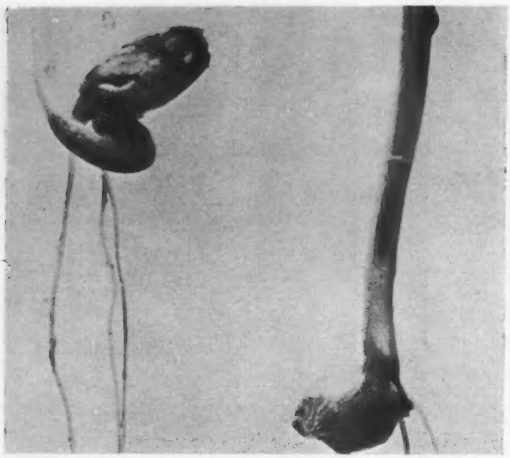
Leaves withered by Septoria tritici and bearing pycnidia

is seedborne on barley also but two species of *Helminthosporium* appear to be of greater potential harm. *H. gramineum* causes barley leaf-stripe, a disease better known to earlier generations of farmers. Apart from Wales and South-West England, this disease is now rarely seen in commercial crops but occasionally it has been seen on varieties in N.I.A.B. trials. Infected plants are severely crippled and the ear remains very thin and partially trapped in the flag leaf.

We have no up-to-date information on the occurrence of *H. teres*, the cause of net blotch of barley, but it seems to be rare. In recent years there have been some severe outbreaks in Australia; the most popular variety of barley was susceptible and yield losses of 17 per cent occurred in plots not sprayed with fungicide. Both these leaf diseases, and covered smut of barley, are readily controlled by organomercury compounds and disappeared after treatment became routine in the 1940s.

Of increasing concern

Advisory plant pathologists in the south and west of England have recently been paying more attention to another *Septoria* leaf spot of wheat which only six years ago was authoritatively described as doing 'no noticeable harm'. Caused by *S. tritici*, the brown leaf lesions of this disease are similar to those caused by *S. nodorum*. On a single diseased leaf patches containing the pycnidia of both species may be interspersed. Mature pycnidia of *S. tritici* appear in the lesions as black pin-heads between the veins, the spores exude as grey-white masses or tendrils. Although this fungus is seedborne there is as yet no standard test for its detection and the effect of seed treatment is unknown. It is world-wide in occurrence and severe attacks have



Wheat coleoptiles attacked by Septoria nodorum. The one on the right shows the diagnostic brown knob symptom; the one on the left did not emerge

been reported from several countries. Spores released from pycnidia occurring on volunteer seedlings and infected stubble seem to be important in continuing the disease cycle.

Septoria leaf spot of oats, caused by *S. avenae*, is of general occurrence in Britain although its overall importance is not known. The early symptoms of infection can be confused with those of *H. avenae* but later pycnidia develop in the *Septoria* lesions. A black discoloration may develop on infected grains. The effect of seed treatment is uncertain; in the U.S.A., where *S. avenae* is considered a major disease of oats, control recommendations are centred on stubble destruction.

A new hazard

Of direct interest to growers of oats is a novel seedborne threat which came to light recently as a result of work in Edinburgh. Standard organomercury formulations were found to be ineffective against certain strains of *Helminthosporium avenae*, the fungus causing leaf spot and seedling blight of oats. Scottish seed harbouring these strains can be attacked despite the correct application of organomercury seed treatments. This failure to control the disease is because the fungus has a real tolerance to the chemicals. Experiments showed that at levels poisonous to other strains, from seed originating from Northern Ireland, these new strains could still grow.

These mercury-resistant strains can be expected in England since so much seed is of Scottish origin. Some field failures have been reported and surveys are being conducted in Scotland and Northern England. Cases of poor emergence of treated oats should be investigated fully. At sowing, a sample of the seed used should be retained—its examination might be valuable in subsequent investigations.

New chemicals are kept under constant surveillance by the manufacturers to see if they are active against disease organisms. It would be surprising if there were none giving protection against the mercury-resistant strains found on oats; in trials abroad chemicals of a different type have proved satisfactory for use on wheat. However, no commercial formulations are expected to be available in this country for some time. The possibility of similar mercury-resistant strains developing in other disease fungi will no doubt stimulate continuing interest in this field.

A major advance

We may be on the threshold of a major step forward in disease control by chemicals or, to use a long word, chemotherapy. It has recently been discovered that certain 'systemic' fungicides are active when applied as a seed treatment. A 'systemic' chemical is absorbed into the host plant and moves throughout its system, conveying fungicidal activity to the various parts of the plant. Some of these chemicals can control certain diseases for several months after application, and some show activity when applied as a seed treatment. It is not impossible that chemicals giving similar long-term protection against the seedborne diseases mentioned in this article may be available before many years are past.

For the present the practical farmer should ensure that his cereal seed is correctly treated before sowing and retain a sample of the seed for future reference. When failures occur expert advice should be sought as soon as possible.

This article has been contributed by **P. D. Hewett, B.Sc., A.R.C.S.,** seed mycologist at the Official Seed Testing Station, a branch of the National Institute of Agricultural Botany, Cambridge. He has paid particular attention to the incidence and importance of seedborne diseases of wheat.

Weather and Agriculture

C. V. Smith

I BELIEVE it was the late A. G. Street, who on being asked what was the most important question in the world today, set out the farmer's enduring interest in weather by the reply 'Will it rain tomorrow?' The meteorologist's reply to the question 'Will it rain tomorrow?' will seldom be an unequivocal 'Yes' or 'No'. The reason for this lies in the characteristics of the physical processes he is trying to interpret—the controls are broad and weather systems are but a reflection of instabilities. Understandably, because of a certain inbuilt randomness of behaviour in all weather systems, the meteorologist would prefer to talk in terms of probabilities or degrees of uncertainty.

The cost of weatherproofing

On the farm, the ability to push on with a particular job is likely to be dependent more upon current weather, in particular upon current rainfall,

than perhaps almost any other factor. This, and uncertainties about the coming weather, are part and parcel of the farmer's life. They add to his overheads, to his production costs and can affect the price he gets for sales off the farm. Uncertainties about the weather complicate both short- and long-term management decisions, for they cannot be ignored.

There are those able to prevent rain by the simple expedient of carrying an umbrella. Either way, rain or no, we have an example of weatherproofing. But most of us have to take the weather that is sent and for the farmer, investment to minimize the effects of weather on his enterprise can be expensive. Money is invested in buildings and durable equipment; working capital becomes tied up in buffer stocks, for example in feed held as a hedge against the severe winter. Certain enterprises, with a profitability known to be less than feasible alternatives, may be carried on simply as some insurance against the vagaries of the seasons.

Working with the weather

We accept that the arable or grassland farmer has in the main to work with the weather. The specialist, intensive livestock unit of today will likely be housed and weatherproofed, with some large measure of control over internal temperature and air-change rate. And yet even such units as these are not independent of the external environment. Insulation is a variable, dependent on exposure to sky and wind. The prime function of the ventilation system is to carry off the waste heat and moisture generated by the animals. The rating of the ventilation system, through design temperatures etc., should properly consider the environmental extremes appropriate to the site. Weather statistics for past years are obviously relevant.

Simply observing and recording the weather can provide the basis for action. The past or recent weather can be used as a reliable guide to such matters as planting date or irrigation need, or to indicate that precautions should now be taken against certain pests or plant and animal diseases.

One can still find the occasional individual (he is likely to be an armchair agriculturist it is true) who has yet to be convinced of the relevance of weather or environmental observations to farming practice and progress. Even when one moves to the farm itself, there is still an apparent reluctance to monitor and record which must appear very casual to the outside observer, when he considers the money apparently at risk. How many people will measure their own rainfall or soil temperature? What percentage of bulk grain or potato stores can be considered adequately instrumented, or make optimum use of the opportunities for conditioning the stacks by ventilation? In the past, how many husbandry experiments have been written up in terms of calendar dates instead of meaningful meteorological parameters?

If the past weather is a pointer to the field operations that would be currently advantageous, then short period weather forecasts can indicate which operations are likely to be feasible or worth while. The bearing of such weather information on day-to-day management decisions is one we take for granted. It raises questions that the meteorologist must attempt to answer. Is it enough simply to generate general weather information and then assume that it will be used effectively? Obviously there are problems of communication. How far is it possible for forecast weather information to be tailored to the specific needs of the farming community at particular times of the farming year? The meteorologist may regard this question as a

non-starter, unless it can be reduced to that of forecasting the occurrence of critical or threshold meteorological quantities. Before forecasts are possible, causative links have to be established between weather variables, husbandry, crops and disease. The applied meteorologist accepts that there is no sharp division of interests between agriculture and meteorology. The record of the agricultural meteorologist in this country shows a willingness to initiate (and to collaborate in) investigations relating to real problems of the farm that have only been limited by the resources the agriculturists are prepared to allocate to problems of mutual concern. Because his public has such varied and even conflicting interests, the synoptic meteorologist may measure the success of a weather forecast by the progress of lines across a sequence of weather maps. The agricultural meteorologist will settle for harsher criteria of success, namely the economic consequences for those who try to use his advice.

A greater knowledge or certainty about the weather or weather dependence would help the farmer to solve his day-to-day management problems. Obviously investigations to this end are going on, but it is of interest to see how one can begin to write weather variables into longer-term management decisions.

Weather and long-term planning

The farmer wants to know the weather of the coming week, the coming month, the coming season. Even longer period climate trends are of interest, though the chances are now that before the meteorologist has a sufficient sample of years to convince himself of a climatic change, agriculture will have adapted to the new frequency distribution of critical weather (perhaps a shorter growing season or more difficult harvest weather than in recent decades). For the farming calendar and the established pattern of agriculture in Britain is not static. It incorporates the average season's weather, even if this shows some slow drift. It is gross departures from the average season's weather that are important.

The problem of the long period forecast may remain essentially a meteorological one for some time, since interpretation and application to farming will only follow on some reasonable degree of forecasting success. The individual features of a synoptic weather map may have a life span ranging from an hour or so, to at most a few days. For this reason, in forecasts for more than a day or two ahead, we begin to talk of general weather types. Over short periods, the modifications of the controls on a weather system by the growth and development of the weather system itself—a kind of feed back mechanism—can often be ignored. In the longer term this is no longer true and, after some period of time, we are forced to talk only of the probability of a certain weather type.

Should the forecast problem prove intractable, this need not mean that weather variations must be omitted from consideration as incalculables. It has been suggested that it is departures from the average that are of interest in an established farming system. If on the basis of past years, probabilities may be attached to the degree of variation from normal, then weather variations may be written into management problems as calculated risks. Readers may be familiar with the decision matrix of Duckham (1964)*, a contingency table in which weather alternatives, and their frequency of

*Duckham, A. N. 1964. *Weather and Farm Management Decisions*, Reading University and Aberystwyth Symposium on Agricultural Meteorology.

occurrence, are set against alternative farming systems, enterprises and levels of investment. The probable return under each combination of circumstances is indicated, say, for a 10-year sample period. Meteorological information presented in this way obviously gives a rational basis for decision.

Practical ends

It might be argued that such an exercise is largely academic, since few will take time to question the whole basis of their farming system. However, the approach is of general application. There can be few farms, for example, where each year some thought is not given to the amount to be invested in machinery or the farm labour to be employed.

The usual method of estimating requirements, and the time likely to be available to execute peak work loads, is through 'Gang Work Days'. Closer inquiry shows that there is no basis for the 'Gang Work Day' figures other than broad experience. The objective and quantitative approach necessary to extend this information to other regions is lacking. Neither can the figures suggest with any precision the capacity of the machinery needed on a particular acreage of a given soil type to cope firstly with the average season and, secondly, to cope with the more extreme season. It has been the concern of a recent and continuing combined exercise by the N.A.A.S. and Meteorological Office to remedy this situation.

Initial attention has been given to the spring cultivations. In 1966, the N.A.A.S. in the East Midland Region organized the return of work days from some 35 farms on a variety of soil types. The Meteorological Office supplied daily rainfall figures appropriate to each farm and, from these, devised criteria which fitted the farmer's decision as to whether soil conditions were suitable for work. Armed with these criteria, it has been possible to refer to rainfall records of earlier years and determine the frequency of the season's total work days (for spring cultivation). For a nominated soil type, probabilities, expressed as so many years in ten, can now be attached to the number of days available to get through the spring cultivations in the East Midlands.

The agricultural meteorologist

Over the years, the agricultural meteorologist has shown that he is primarily concerned with very practical ends. Because his interest is in closing the gap between ideas and their application, rather than in ideas by themselves, it will come as no surprise to those familiar with British science, that the number of agricultural meteorologists in this country can literally be counted on the fingers of one hand.

In the eyes of the general public, the meteorologist is a weather forecaster. In his studies of the interaction between weather or environment and the many facets of agriculture, the meteorologist may prefer to be seen as an experimental physicist. He will want to measure, monitor and develop new procedures and instrumentation where present techniques are inadequate. We are not 'Big Science'. I suggest it would be a misfortune for all, if, for want of very limited resources, agricultural meteorology were forced to retreat from field work into paper work, back into the world of ideas alone.

This article has been contributed by **C. V. Smith, M.A. (Cambridge), Natural Sciences, B.Sc. (Lond.), Special Physics,** of the Meteorological Office who is at present attached to the N.A.A.S. at the Regional Office, Cambridge.

Intensifying Dairy Heifer Rearing

This article has been prepared from a study of dairy heifer rearing made by the N.A.A.S. South-Eastern Region Dairy Community Group as exhibited at the Grassland Research Institute, Hurley Open Day in September 1967

SOME systems of beef production are very closely supervised; the target date for slaughter is fixed when the calf is born and progress is checked by regular weighings. Supervision is even more necessary with dairy heifer rearing because, while failure to reach targets with the beef animal may only delay slaughter by a few months, failure with a dairy heifer may mean that service and hence calving is delayed by a whole year if calving in a set season is required.

Many dairy farmers have intensified the grazing of the dairy herds so that in some instances cows are stocked in the summer at as many as two cows per acre. Fewer farmers have improved the heifer rearing enterprise to the same extent; either the land used is incapable of intensification or, because of its inaccessibility to the dairy herd, improvement by using fencing, fertilizers or providing water for paddock grazing has not been considered.

Rearing and subsequent performance

Rearing standards may be defined by condition, age, size, heart girth or weight at calving and there is a vast amount of literature on their effects on subsequent fertility, lactation and longevity. It is nonetheless difficult to offer precise standards and any recommendations will vary according to breed.

Weight at calving is easy to measure and provides the best correlation with subsequent lactation, but it is necessary to consider how the gain in weight is spread over the rearing period. The effect of the plane of nutrition at different stages on subsequent lactation is well reported in the literature, but the findings are contradictory. Many of the experiments suggest that a high plane of nutrition, particularly in the calfhood stage, has a detrimental effect on both lactation and longevity. In some of the experiments the poor results obtained from high plane rearing may be due to a greater age at calving than was necessary, and in some the standardization of treatment for a few weeks before calving resulted in a restriction of the high plane heifers and a steaming-up of the low plane heifers, thus possibly making comparisons of subsequent lactations invalid. Breeds may differ in the response to plane of rearing, a high plane having a particularly detrimental effect on Jerseys and Shorthorns.

Work at experimental husbandry farms indicates in any case that high plane rearing in the calfhood stage is uneconomic, because compensatory growth on grass has brought high and low plane reared heifers to very similar weights at calving.

The majority of the reports dealing with Friesians suggests there is no ill effect, in subsequent lactation, from rearing on a sufficiently high plane of nutrition to allow calving at two years old. The literature is more confusing, however, on faster growth to allow still younger calving; some recent work indicates this is possible while others report only failure.

How big at calving?

Very small heifers that have stolen the bull are known to be poorer yielders than normal-sized animals and very high weight gains in the calfhood stage are uneconomic, whether or not they are undesirable for subsequent lactation performance. It would seem reasonable to suggest that for the Friesian breed live weight at six months should not much exceed 300 lb and that live weight taken one week before calving should be 1,120 lb, i.e., not appreciably less than 1,000 lb at 3 days after calving. The following table of live weights may be a useful guide:

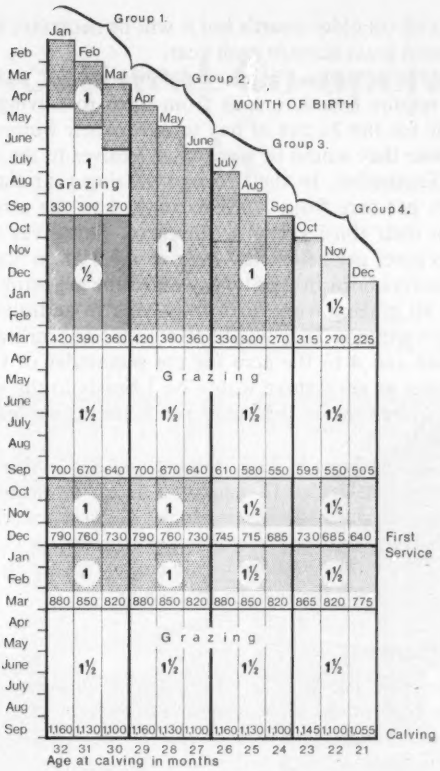
	Mature weight	*Weight at service*	*Weight at 1 week before calving first calf*	*Birthweight of calf*	*Weight at 3 days after calving first calf*
	lb	lb	lb	lb	lb
Friesian	1,250	725	1,120	85	1,000
Ayrshire	1,000	600	900	70	800
Guernsey	950	570	850	60	760
Jersey	800	480	720	50	640

These weights can be achieved at vastly different ages, according to plane of nutrition used. However, economic and biological efficiency would suggest that they be attained as early as possible; a saving of £20 can normally be achieved by calving at two years old rather than three. This holds true except in very exceptional farm circumstances such as the need to use poor unimprovable grassland, when season of calving need not be considered and when there is a detrimental effect on lactation.

Planning the weight gains

As most dairy farmers require their heifers to calve in the autumn to maintain a predominantly winter or level production from their herds, the following table presents a plan for liveweight gains for autumn calving heifers.

For example, a September-born Friesian heifer calf, weighing 90 lb at birth and with a liveweight gain per day during the first six months of 1 lb, would weigh 270 lb at six months of age. Subsequently, a gain of 1½ lb per day would bring it to the desired bulling weight of 685 lb at fifteen months and 1,100 lb at calving. Lower liveweight gains would be adequate for those required to be calved later than twenty-four months; for calving at twenty-one months, gains slightly in excess of 1 lb per day in the first six months are necessary.



The estimated winter feeding costs for the four groups are:

Group I	Born January/March	£44
Group II	Born April/June	£47
Group III	Born July/September	£41
Group IV	Born October/December	£37

These figures suggest that where possible, rearing should be confined to heifer calves born between July and December. It is unfortunately true that many good cows in winter dairies calve in the spring, but unless there are a large number of them in one herd it is probably sound economics to sell the calves.

The literature on liveweight gains which can be achieved by heifers at grass at different stocking rates and nitrogen usage is very sparse. However, there is much information on the liveweight gains of beef cattle under rotational grazing managements and an attempt is made to draw comparisons from these experiments. The stocking rates which result from these calculations are quite startling. They are dependent on grassland management of a high order, upon a nitrogen usage of 250–300 units per acre per annum and upon a rotational grazing system based on eight paddocks for all heifers weighing more than 300 lb at turnout. Parasitism can wreck any plan and hence a newly-sown sward is recommended for the younger calves. In-calf

heifers are less at risk on older swards but it will be necessary to renew about one-third of the total grass acreage each year.

The heifers born in January, February and March, i.e., those in Group I, are estimated to require one acre each from birth to calving; this includes grassland set aside for the 35 cwt of hay to cover their winter requirements. In their first summer they would be stocked at 7 calves to the acre from June until the end of September. In their second grazing year the stocking rate would be 5 calves per acre from April to June, 4 to the acre from July to September and in their third year 3 to the acre. This gives a total grazing area of two-thirds acres per heifer, leaving one-third of an acre for hay.

The Group II heifers born in April, May and June are estimated to require 0·9 acre each for all grazing from birth to calving in addition to the 35 cwt of hay for their two winters. They would be stocked as yearlings at 5 per acre from April to June and 4 to the acre for the remainder of the summer. In their second summer at grass there would be 3 beasts to the acre. This gives a total grazing requirement of 0·55 acre per heifer again leaving one-third of an acre for hay.

The Group III heifers born in July, August and September have the same grazing requirements as Group II, i.e., 0·55 acres but would require only some 29 cwt of hay and so the total acreage per heifer is reduced to 0·8 acres.

The October, November and December born heifers in Group IV would also require 0·55 acres for grazing but would eat just under 26 cwt of hay and would need only 0·75 acres from birth to calving.

Effect on the finances

These theoretical stocking rates are much higher than are usual in practice with dairy heifers, but should be attainable in the light of experiments with beef cattle of similar weights and with similar liveweight gains. The financial effect of this intensification of the dairy replacement enterprise is shown in the following table:

Gross margins per acre

Total acres per head to calving	Forage variable costs per acre	Calving age 33–30 months	Calving age 30–27 months	Calving age 27–24 months	Calving age 24–21 months
	£	£	£	£	£
0·75	12	69·1	65·5	69·2	72·4
1·0	8	52·8	50·1	52·9	55·3
1·5	3	37·5	35·7	37·6	39·2
2·0	2	28·4	27·1	28·5	29·7
2·5	1	23·3	22·2	23·4	24·3
3·0	1	19·3	18·4	19·3	20·1

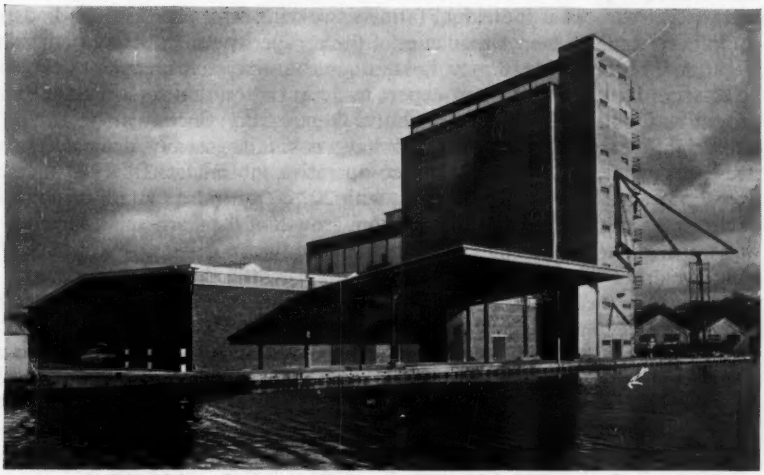
Oxford Farming Conference

The theme for the twenty-second Oxford Farming Conference, to be held in the Town Hall, Oxford, from 8–10th January, 1968 will be **Land-Use or Abuse?**.

The programme and full details are obtainable from the Hon. Secretary, M. H. R. Soper, O.B.E., University Department of Agriculture, Oxford.

Agricultural Co-operation in Britain

S. R. O'Hanlon



Animal feedingstuffs mill at Ware, Herts.

BORN out of the distress and degradation of the Hungry Forties of the nineteenth century, Robert Owen's vision of a consumers' co-operative enterprise as a way of business has today materialized into one of the salient features of Britain's economic structure. The foundation stone of this movement, which was to become world-wide, was laid on 28th December, 1844. It was a modest store in Toad Lane, Rochdale, belonging to twenty-eight flannel weavers. The store is still there, standing both as a monument to these early pioneers and as an inspiration to modern endeavour. The application of the co-operative principle to British agriculture came in 1867, when Edward Owen Greening, one of Owen's disciples, and a few friends registered the Agricultural and Horticultural Association in Manchester for the joint buying of farm supplies of known quality and purity for its members. Other similar enterprises soon followed, notably the Aspatria Agricultural Co-operative Society, now the oldest surviving agricultural co-operative in Britain, which was formed by a group of Cumberland coastal farmers to safeguard their interests in the purchase of the newly introduced 'chemical manures'.

Workers in the countries of northern Europe, particularly in Denmark, were quick to see the potential advantages of the co-operative idea, but in a predominantly agricultural economy their efforts were naturally concentrated into rural, rather than industrial, channels. We need look no further than the closely integrated co-operative organization as it exists in Denmark and the Netherlands today to see what strength lies in communal self-help when well-disciplined and expertly managed.

Development

Perhaps the most important single influence in the establishment of agricultural co-operatives in Britain, however, was the work of Horace Plunkett in Ireland. Here, in the last decade of the nineteenth century, when land reform was giving the Irish peasant security of tenure and possession of his own holding, he was tireless in advocating the value of co-operation, for he saw that without it individual farmers, working with primitive methods, could never achieve even a modicum of the prosperity which they visualized might now be theirs. He foresaw how valuable co-operative creameries could be to serve Ireland's important export trade in butter, and to stimulate the project he founded the Irish Agricultural Organization Society in 1894. Not until eight years later did England have a similar society dedicated to strengthening her own agricultural co-operative movement. By 1920 there were 1,558 agricultural co-operatives, with 207,000 members and a turnover of close on £18 million, but the mushroom growth of the many small societies was too weak to make any effectual challenge in a post-war, revived commercial market. The result for the movement was little short of catastrophic; many societies died, confidence was undermined and for fifteen years interest in agricultural co-operation was at a low ebb indeed.

If a severe blow had been dealt to the reputation of agricultural co-operatives, the concept still flourished. Profiting from the lessons learned by past mistakes and strengthened by amalgamations, by 1939 the lost ground had been recovered. The Agricultural Co-operatives Managers' Association formed in 1936 to represent the business side of the movement and liaise with the National Farmers' Union and other major agricultural bodies, began to exert a powerful influence; and later the Agricultural Central Co-operative Association (now the Agricultural Co-operative Association), backed by the N.F.U., further consolidated and advanced the fortunes of the movement. In 1956 the number of societies had grown to 247 and were turning over an annual trade of more than £117 million. The latest figures available (1965) show membership standing at 303,077, with a turnover of close on £203 million. Most of the 918 societies are large and multi-purpose, trading predominantly in farm requirements (58 per cent) and engaged in marketing (41 per cent). These figures speak for themselves as a tribute to the indefatigable work of the A.C.A. and the spread of confidence in the advantages which co-operative enterprise can offer.

The new scheme

It is appropriate that in this year which marks the centenary of the agricultural co-operative movement in Britain, the Government should be introducing under the new Agriculture Act its Agricultural and Horticultural Co-operation Scheme to foster co-operation in production and marketing. 'A good many farmers are now more readily accepting the need for joint

action', says the White Paper on *The Development of Agriculture*, 'but the Government do not think that farmer co-operation in all its aspects has gone far enough'. In the economic climate prevailing and taking heed of the writing already on the wall for even greater intensification in the future, farmers must of necessity look to the scale of their enterprises. The farm gate can no longer be the horizon of productive effort; the better marketing of produce, perhaps in more uniform descriptions and in bigger lots, is the natural extension of production. Whether or not Britain succeeds in entering the Common Market, we can expect greater competition from Europe. For many farmers, and particularly men with small units, group action offers a solution to diminishing profit margins that should not be ignored.

Administration of the Scheme, which will apply throughout the whole of Britain, will be one of the functions of the Central Council for Agricultural and Horticultural Co-operation (Chairman, Mr. Roger Falk), a statutory body which has been set up with the main purpose of promoting and developing agricultural co-operation. Approved plans that will attract the grants embrace, *inter alia*, pioneering activities, surveys and feasibility studies, the setting up of co-operatives and groups, the training of managerial staff, and the provision, enlargement or adaptation of buildings and other fixed equipment. This must surely be an effective shot in the arm for the movement, helping to give farmers the same advantages as their counterparts across the Channel, and the A.C.A. has been quick to express itself as being very much in favour of the proposals.

A new structure

This Scheme will, of course, also be seen as another measure in the evolution of a new structure for British agriculture. Whilst there will always be a place for the small farm, so long as it is operating with sufficient capital under efficient management and concentrating on that form of enterprise for which it is best suited, it must be recognized that we are moving steadily towards a pattern of bigger farms that will operate with all the advantages of scale. In such conditions there can be no place for shoe-string farming; competition will be effective only by farming in concert. We shall do well to remember the lessons of the 1920s. Rather we should look for a well-co-ordinated co-operative organization with both horizontal and vertical integration, and this will call for discipline on the part of individual farmers and some expert farm business guidance.

Speaking at the A.C.A. Centenary luncheon, H.R.H. the Duke of Edinburgh said: 'Co-operative activity has acquired a particular meaning. Merely because a co-operative system exists does not mean that it is bound to be efficient or profitable. Co-operatives, as any other form of industry, depend on good management. The land is the workshop of agriculture and it is farmed by a multitude of occupiers. Their speciality is the cultivation of the soil and, for them, joint ownership of the means of buying and selling certainly seems the most obvious solution. Without co-operatives, the small farmer would have been out of business years ago. Since farming became an industrial occupation, small farm units have had to co-operate or perish.'

It must be accepted that a hard core of entrenched individualism and myopia has still to be overcome if the agricultural co-operative movement in this country is to achieve its full stature, but now is the moment of opportunity when, with foresight and careful planning, farmer-controlled businesses may place a firm stake in the future.

Freeze Branding

Trials at the National Institute for Research in Dairying have been carried out to assess this new system of branding. The following report has been prepared on the technique and results so far obtained.

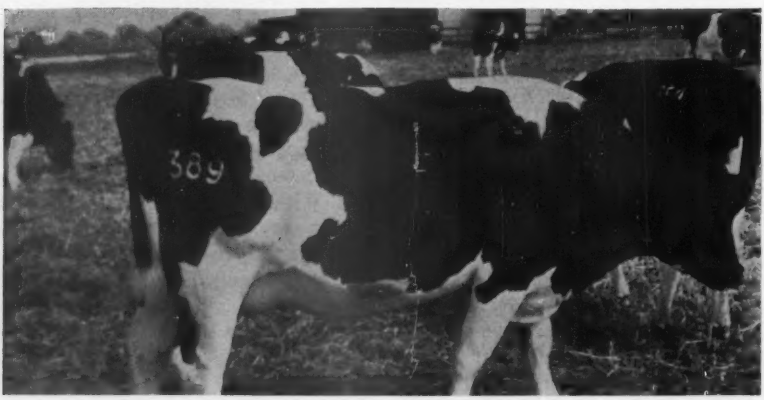
J. Connell **F. H. Dodd** **G. S. Raingill**

RAPID, accurate identification of cattle is necessary for dairy herd management, and except in the smallest herd a visual means of identification is essential. Ear notching and tattooing are permanent, but require animals to be restrained for examination. There has been much improvement in neck, leg and tail bands, and ear tags, but none are yet completely permanent and the numbers are usually small, and effective only if viewed at close quarters. Because fire branding is painful and not acceptable, other branding methods employing caustic chemicals have been used. These are reasonably successful, but damage the hide and the brands become indistinct after a year or two. The freeze branding technique developed by Farrell, Koger and Winward (1966) at Washington State University shows considerable promise in providing a very satisfactory permanent brand.

The principle of freeze branding is that the intense cold of the branding iron destroys the melanocytes (the pigment forming cells of the hair follicle) and subsequent growth of hair on the branded area is white.

To solve our own problems of cattle identification at the National Institute for Research in Dairying, trials have been carried out to assess the system of branding. It has proved to be successful and, because of the interest shown in the investigations, the following report has been prepared on the technique and the results so far obtained.

Cattle graze—clearly identifiable



Profuse growth of white hair four months after freeze branding

Procedure

1. For freeze branding the animals were restrained in an effective cattle crush. Some animals struggled at the time of branding, but thereafter showed no discomfort.
2. As far as possible the red or black part of the animal's coat to be branded covered firm muscle so that when the branding 'iron' was held in position there was even contact, and pressure could be applied. The area to be branded was closely clipped and washed with 95 per cent ethanol, ensuring good brand contact and preventing the super-cooled metal from sticking to the skin.
3. The coolant used at the N.I.R.D. was a mixture of crushed solid carbon dioxide and 95 per cent ethanol. If the ethanol is not at least 95 per cent pure, the mixture will freeze. The mixture was kept in an insulated bath (see photograph on p. 572). To maintain the desired temperature of −70°C a solution saturated with solid carbon dioxide is required. This mixture, which can be re-used, is dangerous to personnel and must be handled with care.
4. The brands are made from 0·5 in. by 0·5 in. brass bar 3·0 in. high, firmly screwed to a brass plate (4 × 2·5 × 0·5 in.) with a brass shaft (8 in. long, diameter 0·25 in.) to a wooden handle. They were immersed in the mixture and when vigorous bubbling stopped their temperature (checked with a thermometer) was −70°C. The appropriate brands were then pressed firmly for 30 seconds on the previously prepared part of the animal's coat. The contact time was measured with a stop watch.

Development of the brand

A frozen impression results from the application of the super cooled metal to the skin, but the tissue thaws rapidly, leaving a corresponding area of oedema and erythema. This is visible for 24–48 hours, after which it recedes and the brand appears dry and scurfy. From this scurfy area variable amounts of hair and epithelium are eventually lost, and it remains visible until the white hair starts to grow. The white hair may take four months to grow, depending on the relationship between the branding time and the normal

Equipment—thermos flask for solid carbon dioxide, basket with bottles of 95 per cent ethanol, stainless steel bath insulated with polystyrene holding the brass bands

seasonal hair growth.

Most of the 52 pregnant heifers, aged 18 months, branded in mid-April, 1967 could be identified at a distance of at least 25 feet by the middle of August, 1967 (see photographs on pp. 570-1). The brands on one animal only could be considered a failure. Even the brand on this animal was as good as would be achieved by the older method of branding with a strong caustic solution. Some of the variability in results is due to the fact that animals moved during branding, and because black or red patches were not always ideally sited on the top of firm muscled areas.

Improvement of the technique

There is no real evidence of how permanent the freeze brand is, although results from the United States indicate that after two years there is no sign of recession. The technique will be improved by making it more rapid, reducing the frequency of occurrence of poor results, and being able to brand the animal in sites readily seen by the stockmen during milking and feeding.

Various metals have been used to make the brand, and any which have a rapid heat transfer are likely to be successful. The Americans prefer copper brands but brass brands, which are much cheaper, appear to be equally successful. The brass brands used at the N.I.R.D. have a flat face, but brands with a slightly convex face may give better heat transfer and improve contact with the skin. If a large number of animals were being branded by an individual, or as a service to the farmer by some organization, at least two sets of brands would be required with a clamp to hold a series together so that each numeral need not be applied separately. Ideal sites for branding are limited, and if it were possible to reduce the size of brand from 3 in. high this would be an advantage. The cooling of the hide will depend upon the initial temperature of the brand, the time it is applied, and its mass. The correct combination can only be found by further investigation.

Various coolant mixtures have been tried, the object in mind being to find one which will reduce the contact time from 30 seconds but otherwise not interfere with the success of the branding nor cause damage to the hide. If the

contact time were reduced the whole operation would be much faster. The Americans have used liquid nitrogen, liquid anhydrous ammonia, jet fluid and mixtures of solid carbon dioxide with isopropanol, methanol and acetone, but the recommendation at present is to use a mixture of solid carbon dioxide and ethanol (95 per cent).

Future investigations

An extension of the contact time to 60 seconds has been proposed as a method of freeze branding naturally white hair. The longer contact time may completely kill the hair follicles so that the brand will appear as bald numerals. This has not been proved, nor has the damage to the dermis of the hide been assessed.

In 1967 the heifers at the N.I.R.D. were three months pregnant when freeze branded at 18 months of age. In future it is planned that heifers will be branded as yearlings so that rapid visual identification will be possible when the animals are to be served. With the present size of brass brand and coolant in use, an attempt to brand a calf at 4 months of age was not entirely successful, primarily because muscled surfaces on which to brand were not sufficiently developed. However, when the brand on this animal was clipped and measured six months later (the animal 10 months old), the numeral had grown by 0·1 in. in thickness and 0·7 in. in height. Further measurements to follow the development of the brand will be made.

If animals are freeze branded on the flank, this is a valuable part of the hide and is not always a site which will be easily seen when animals are tied for feeding or milking in a parlour. The fact that many cows must be identified both from the front for feeding and the rear for milking is an important part of the problem of cattle identification which has long been with us, and will be more so as herds increase in size. A more convenient place for branding would be the thigh rather than the flank, but with the present brands, coolants and the unsatisfactory surface, this would probably give poor results.

Conclusions

Although in large herds recognition of cattle may eventually be done electronically, there will always be a need for a visual identification. Of the various methods of visual identification either in use or proposed, freeze branding appears to be the most promising. The methods used at the N.I.R.D. gave very successful brands, clearly legible from a distance of several yards. Further research is required on the age at which branding is done, design and size of brands, coolants, contact times, effect on the hide, development of the branded area, and the permanence of freeze branding.

Reference

Farrell, R. K., Koger, L. M. and Winward, L. D. (1966). Freeze branding of cattle, dogs and cats for identification. J. Am. vet. med. Ass. 149, 745–752.

This article has been contributed by **J. Connell, B.Sc., M.Sc., N.D.A., F. H. Dodd, B.Sc., Ph.D.**, of the National Institute for Research in Dairying, Shinfield, Reading and **G. S. Raingill, N.D.A.** who was at N.I.R.D., but is now with the Beecham Research Laboratories at Brentford, Middlesex.

The Adjustment Process in Agriculture

S. J. Rogers

DESPITE its traditional image as a quiet, unchanging industry, agriculture has, in fact, undergone a revolution in the last 25 years. This revolution has been technological in its nature. Yields of all crop and livestock enterprises have increased dramatically. Taking cereal growing as an example, yields have increased more in the last 20 years than in the preceding four centuries. For almost every agricultural enterprise the input/output ratio, i.e., the technical efficiency, has improved significantly and there have been substantial changes in all methods of commercial production, with the possible exception of beef and sheep. These changes have involved extensive mechanization and the adoption of new techniques for handling crops and livestock.

Capital and labour

These developments have made it possible for British agriculture to produce more output, more efficiently than ever before. However, such changes in technology have additional characteristics which will affect the whole structure of agriculture as an industry. In the first place, most of the changes not only increase output, but also change the use within the individual farm business, of capital and labour, calling for a substantial increase in the amount of capital required, and permitting the release of labour for alternative employment. Thus between 1955 and 1965, the amount of annual gross capital formation in agriculture (for vehicles, plant, machinery, buildings and works) has increased from £104 million per year to £176 million per year to which must be added additional working capital needed to finance expansion of output. During the same time agriculture has released 180,000 men who were full-time employees. During this period agricultural net output has increased by approximately 40 per cent.

Table 1

Dairy herd size and cost of milk production

Herd size (*No. of cows*)	Total cost (*d. per gallon*)
6–19	38·5
20–39	33·0
40–59	30·9
60–99	30·0
100 and over	29·3

Source: *The Milk Producer* 1966

Economies of scale

The second characteristic of the new technology is that, for the most part, it has led to increasing economies of scale, so that as the size of enterprise increases, unit costs become even lower. For example, a recent survey of the costs of producing milk indicated that the average cost of production declined as size of herd increased as shown in the table on p. 574.

Similar figures could be cited for pigs, poultry, cereal growing, vegetable production and, in fact, most farm enterprises. In the light of these economies of scale it is not surprising to find that over the past decade concentration and specialization have been dominant features of the industry. The table shows the extent of these changes over the last few years.

Table 2

Specialization and size of enterprise in England and Wales

Type of enterprise	No. of holdings with the enterprise		Enterprise size group	% of total enterprise in size group	
	1960	1965		1960	1965
Dairy cows	140,109	114,497	50 or more cows	21	30
Beef cows	64,050	61,022	50 or more cows	15	19
Breeding ewes	87,795	83,755	500 or more ewes	16	21
Breeding pigs	81,843	73,040	50 or more sows and gilts	16	25
Wheat	77,721	65,373	100 or more acres	26	42
Barley	90,826	106,292	100 or more acres	41	50
Maincrop potatoes	92,327	65,830	50 or more acres	19	27
Fowls 6 months or over	216,501	187,376(*a*)	1,000 or more birds	25	46(*a*)
Broilers	5,729	2,790	20,000 or more birds	42	71

(a) 1963. In 1965 there were 158,103 holdings with fowls for producing eggs for eating and 62 per cent of laying fowls were in flocks of 1,000 or more birds.

Sources: Agricultural returns, Ministry of Agriculture, Fisheries and Food. *Structure of Agriculture*. H.M.S.O. 1966.

Although the industry has made considerable progress during the post-war era, it is clear from the last two columns of the table that there is still room for even greater efficiency and, whatever the level of total output of the industry, economies could be achieved by concentrating production into fewer farm businesses of larger size.

These increasing economies of scale also have a direct relevance to the level of farm income. By and large the demand for agricultural produce is relatively stable and the total size of the market is increasing very slowly. As a consequence, any expansion of total production in excess of the growth of demand can only be disposed of at lower prices—which then reduces the income of industry as a whole, but in particular those who have small farm businesses and those who have not expanded. Faced with a market which is fairly static, the only way of increasing agricultural income per head is to reduce the number of heads, i.e., the number of farmers and farm businesses. Thus, both on grounds of increasing farm incomes and of increasing efficiency, there is a good case for an agricultural industry of fewer, larger farm businesses.

Social implications

Such change cannot be considered, however, without looking at some of the social implications. To reduce the number of farmers calls for some of the existing farmers to move out of the industry. Migration, however, can

involve personal suffering, both economic and non-economic. Furthermore, many of those who fare the worst in farming and might therefore be regarded as being the most likely to leave the industry, may be quite unsuited—either because of age or ability (education, training, etc.)—for alternative employment. Structural reform might then achieve efficiency within agriculture, but it would create the problem of absorbing persons elsewhere who might be least suited to non-agricultural employment. In addition to farmers themselves, it is also necessary to consider agriculture as a whole in areas where it is the predominant industry, since a rundown of the number it employs may have a profound effect in rural communities. Reducing the population may lead to difficulties in providing 'adequate' social services at a reasonable cost.

If one accepts that the economic requirement should be an important determinant of the shape of agriculture tomorrow, one must then ask how this can be brought about. One answer would be to hope that competitive forces in themselves would bring about these changes—as argued by the traditional liberal economists. What these competitive forces would have to provide is an economic climate which is favourable for the expansion of larger farm business, while at the same time it is sufficiently unfavourable to the small, less efficient businesses to urge them to leave the industry. In practice there are good reasons to suppose that this will not prove a very effective mechanism. The small farmer may be producing at a higher total cost than larger farmers but many of his costs, including his own and his wife's labour, the return of his own capital, are items which he could forego to some extent by tightening his belt. To let the free market operate may lead to such low prices that on the one hand it is not profitable for the new technology to develop while, on the other hand, the dereliction of agricultural land and the degree of economic hardship suffered by individuals would be quite unacceptable.

Given that structural reform of the industry is part of the normal economic progress and to be encouraged, and that the automatic processes of competition are unlikely to work satisfactorily, it is necessary for governments to intervene in a much more direct way. It can be noted that this is similar to the intervention which has taken place in price policies, where it has been argued—for more than thirty years—that a completely unregulated system has many undesirable attributes.

The phenomenon of 'adjustment' described above is not confined to British agriculture. Examples can be found in the agricultural industries of most industrial countries in Europe and America. Neither is the phenomenon confined to agriculture. There have been similar developments in many, even most, industries in the British economy, ranging from coal mining to retailing, including such diverse industries as textiles, shipbuilding and even aircraft production. The question of how to tackle such a situation is therefore of major importance to the British economy at the present time.

Concerning agriculture in Britain, the Government has recently introduced measures to help in the process of structural change. These are contained in the Agriculture Act 1967. In this Act, there are provisions enabling retirement grants to be given to those farmers who leave their farms, enabling amalgamations to take place, thereby facilitating their exodus. At the same time grants are available which will help a farmer to finance the amalgamation of another holding with his existing farm into a larger, more viable business.

The Act also enables Rural Development Boards to be established in areas which have special problems. When the need for structural reform may call for a marked reduction in the number of farms in one area, the process of individual farm amalgamations may be too slow, or even impossible to achieve. Within the area of a Rural Development Board, it will be possible to consider more far-reaching changes in land occupancy.

This Act has only recently been passed and it will be some time before its effectiveness can be judged. Some preliminary observations can, however, be made. One can ask whether the Act has gone far enough. Firstly, it does not affect the larger farm business amalgamations. Yet, in terms of economic potential, increasing efficiency through creating much larger farms would be more significant to the economy as a whole, than lifting small farms to the not-quite-so-small levels. In view of the problem presented by the cost of agricultural land in relation to its earnings, by the incidence of death duties and the capital gains tax, it may be pertinent to ask whether some action will not be required in this area. Secondly, if the number of small farms is to be drastically reduced it may be appropriate to consider measures to discourage those new entrants to the industry who, because of the capital limitations, will unavoidably aspire to no more than small farm businesses. The old concept of the 'farming ladder' may be quite inappropriate in the new type of agricultural industry. Even in its heyday the 'farming ladder' was, for all but a few exceptional farmers, one rung high. It may also be advisable to introduce additional measures to help existing small farmers to move from their farms.

Structural change

These comments are, however, marginal to the main argument of this article. The important consideration is that the agricultural industry is bound to change its structure, if it is to offer adequate opportunities to those people who are engaged in it. The recent emphasis on the import-saving role of agriculture should not be allowed to divert attention from this fact. The proposed expansion of the industry may offer some short-term benefits to farm incomes, but in the long-run it will be necessary to face the fact that structural change is taking place, that it is in the interests of greater efficiency, but that it may place individual farmers, groups of farmers, and even whole rural communities, in a difficult situation. Once these problems and hardships are recognized for what they are, namely, the consequences of economic change, appropriate policies can be formulated. We live in an age of enlightened concepts of welfare. It should be possible to allow, and encourage, economic developments to proceed, but at the same time ensure that individual hardshipis minimized—whether this is by compensation, or by creating alternative career opportunities and facilitating the uptake of these opportunities by those concerned.

Agriculture today is an industry in transition which is exciting, but sometimes painful. There is the old cliché that 'one can't make an omelette without breaking eggs' but one need not break more eggs than is necessary and some of those which are broken can be used for alternative, but equally nutritious dishes. To facilitate the transition in agriculture, there are two requirements. The first is an overt recognition of what is happening and will continue to happen. The second is a set of policies designed to accommodate this. The Agriculture Act of 1967 is a start in the right direction.

This article has been contributed by the Agricultural Adjustment Unit of the Department of Agricultural Economics at the University of Newcastle upon Tyne.

M. Roberts, Director of Pwllpeiran Experimental Husbandry Farm
discusses the type and level of supplementary feed for the ewes in late winter and spring

Feeding of Hill Ewes

THE serious limitations inherent to most mountain sheep farms may well be known, but it would be as well to list a few of them before discussing any one particular problem. Altitude, climate (high rainfall and low temperature), low inherent fertility and topography seem to pose insuperable problems at the present stage of knowledge as far as land improvement is concerned. This, in turn, sets limitations on the type of animal that can be bred to survive and produce under such harsh conditions.

One of the most important and controversial issues affecting the productivity of mountain ewes is the type and level of supplementary food to be provided during the late winter and spring. In Wales, the peak lambing period occurs during early April which means that the critical stage of late pregnancy (late February and March) as well as the first month after lambing, coincides with the time when production of natural hill pastures is at its lowest. Deficiencies in both quality and quantity of the food on offer at this critical time can obviously affect the number of lambs produced, the rearing capabilities of the ewe, as well as the amount of wool produced. There is, however, a tendency to assume that this is the only factor limiting production on mountain farms; nothing could be further from the truth, because there is also a definite limit to the number of breeding ewes any particular area of mountain will carry successfully and in a productive state during the summer months. There is very little point in spending a great deal of money on any form of supplementary food during the winter to produce a heavy crop of lambs if through overstocking of the hill during the summer, these extra lambs cannot be reared satisfactorily to a reasonable live weight in about 18 weeks.

Trials carried out at Pwllpeiran Experimental Husbandry Farm before 1963 on supplementary feeding of mountain sheep for six to eight weeks before lambing, indicated quite strongly that a high protein concentrate (22–24 per cent C.P.) food did not give entirely satisfactory results. Although the ewes given this high protein supplement produced 12 per cent more lambs than the control group receiving no purchased food, they also had a much higher percentage of small lambs at weaning (i.e., 16–18 weeks old) which seemed to indicate that the ewes fed on high protein concentrate on the enclosed hill before and after lambing suffered a check when they were turned back to the mountain, and where it was not possible to continue this system of feeding.

Following on these earlier trials, an experiment was initiated in 1964 to compare the effect of feeding supplements containing different levels of vegetable protein to 2-year old ewes for six to eight weeks before lambing. Four groups with 40 ewes in each group which had similar performance as yearlings were given 6 oz per head per day of concentrates containing 10, 12, 15 and 18 per cent crude protein with an additional control group receiving nothing at all apart from the hill pasture which was common to all five groups. The two hundred ewes were separated for feeding every day in portable sorting pens with a five-way drafting race.

Table 1

Supplementary feeding to two-year old ewes—Mean of three years' results 1964–66

	Control	10 per cent	12 per cent	15 per cent	18 per cent
October weight	61·3	61·1	61·8	61·7	61·6
July weight	54·0	55·3	56·3	57·1	57·0
Wool weight	2·24	2·70	2·56	2·66	2·58
Birth weight of lamb	5·0	5·1	5·4	5·3	5·3
Lambing percentage	77·5	85·0	88·3	81·7	80·0
Rearing percentage	84·6	90·3	93·8	89·1	85·0
Wt. of lamb at 18 weeks	38·4	39·4	40·1	41·6	41·4
Feeding costs per ewe	—	5*s.* 3½*d.*	5*s.* 6¼*d.*	5*s.* 10*d.*	6*s.* 2½*d.*

The results over a 3-year period indicate that the optimum level of protein in supplementary feeds for this class of ewe under hill conditions would seem to be around 12 per cent crude protein. The performance of this group measured as total live weight produced at weaning is superior to all other groups, which leads to the conclusion that there seems no advantage to be gained by feeding a supplement containing more than 12 per cent crude protein. When one considers the cost of supplementary feeding in relation to the increase live weight produced by the supplemented groups over the control group, we get the results shown in the following table:

Table 2

Comparative costs of liveweight gain per 100 *ewes fed*

	10 per cent	12 per cent	15 per cent	18 per cent
Increase live weight of lamb over control in lb	373·0	564·8	422·7	336·0
Total cost in shillings	529·1	552·1	583·3	620·8
Cost per lb of extra live weight produced	1*s.* 5*d.*	11¾*d.*	1*s.* 4½*d.*	1*s.* 10½*d.*

It must be remembered that these results refer to the performance of 2-year old ewes which are usually the least productive section of the flock. One would expect older ewes to produce lambs with substantially better live-weight gains, but nevertheless, it does illustrate the importance of keeping the cost of supplementary feeding down to economic limits. At the present market value of store lambs, the only group giving an economic return is the 12 per cent crude protein.

On further appraisal of the results of this experiment, it would appear that the percentage of lambs born dead and late abortions vary according to the level of protein in the supplementary feed. The lowest percentage occurred in 12 per cent crude protein group while higher percentages occurred in the un-fed group, (i.e., control) and the 18 per cent crude protein group. A pilot trial run in 1966 comparing vegetable protein and a non-protein nitrogen as the source of protein in the supplementary food showed that more abortions and lambs born dead occurred in the vegetable protein group. Furthermore, our experience at Pwllpeiran with sheep fed urea as a source of protein in the supplement confirms that the number of lambs born dead and aborted tended to be much lower than when conventional sources of protein are used.

Following on these observations, a further trial on supplementary feeding with 3-and 4-year old mountain ewes was initiated in 1967 to compare non-protein nitrogen as a source of protein with the conventional vegetable source at two different levels. The one year's results show that the urea-fed group gave the best lambing percentages and heavier lambs at 16 weeks old at very little extra cost ($\frac{1}{2}d.$ per ewe) over the group receiving cereals only. Bearing in mind the importance of keeping down the costs of production and that only a small amount of protein seems to be required to attain the optimum level, it is possible that urea or other non-protein nitrogen could play a more important role as sources of protein in the future.

Self-help system of feeding

It is almost impossible to design a critical experiment comparing different levels of feeding or different types of food under free range conditions, because of the difficulty in enclosing three or four acres of mountain that would be identical and comparable in every way. The probability would be that the areas would vary as far as overall altitude, topography, aspect, degree of shelter or exposure and its ecology is concerned. Any differences obtained in different supplementary feeds may be masked by wide differences in land productivity.

In the self-help system we have evaluated, the food is manufactured as a block weighing 56 lb and the essential ingredients are 50 per cent cereals, 6 per cent urea, 15 per cent common salt, 2–3 per cent minerals, 26 per cent molasses and a resinous binding material which also makes the block reasonably weatherproof. The blocks are distributed as far as possible over most of the mountain, allowing one block per 25–30 ewes per week. The number of blocks in any particular part of the mountain would vary according to the density of the sheep grazing the various areas at different periods of the winter. Intimate knowledge of the mountain grazing and the grazing habits of the sheep is essential, if one is to accomplish a sensible distribution of the blocks, since their main advantage over other foods lies in the fact that a supplement is made available to ewes on their natural grazing habitat.

In 1964–66, approximately 400 ewes grazing on a 700-acre area of enclosed mountain were allowed access to the blocks for a period of 11 weeks. The mountain is exposed and varies in elevation from 1,600 to 1,850 ft above sea level. The main plant association in order of importance on this mountain is heather/sheep fescue/nardus, sedge/cotton grass and molinia sedge/cotton grass; therefore, there is no doubt that this fairly high and exposed mountain of indifferent grazing is a rather severe test of the hardiness for any breed of sheep in an average winter.

In years prior to 1964, our experience with a similar number of ewes wintered on this area of mountain is that we could not expect a lambing percentage of much over 80 per cent in a very open winter and spring, and the average over a number of years would be in the region of 65–70 per cent. In the years 1964 to 1967 when given access to this supplement, the lambing percentage has been over 93 per cent. Over the four winters, the average consumption has been rather less than 5 oz per head per day and when feeding from mid-January to the end of March (i.e., over 11 weeks) the cost per ewe is 12*s*. It is estimated that this gives on average an increased lambing of over 23 per cent as well as higher live weight of lamb at weaning and more wool. The increase in gross margin resulting from this method of feeding should be approximately 5*s*. per ewe.

In comparison with this self-help system of supplementary feeding, ewes of similar age groups were brought down to more accessible land of improved pasture in mid-January and given hay *ad lib*. plus 5 oz of concentrates per day for 11 weeks before lambing. The performances of both groups were very similar and so were the costs and the results would suggest that ewes can be wintered on this self-help system, in a productive state on poor mountain land, thus helping to overcome the serious problem of over-grazing the lower hills and fields during the winter and spring which reduces their summer production so much. Furthermore, this self-help system would open the possibility on the more favoured hill farms of releasing a part of the lowland area for more productive usage such as rearing of crossbred sheep, thus increasing the size of the business and also producing an article more in keeping with market requirements of the present day. Finally, this is a low labour demanding system of feeding and with the ever-increasing scarcity of hill shepherds, any system which assists in increasing the number of ewes per man that can be managed successfully is worthy of consideration.

The Prevention and Control of Poultry Diseases (2)

R. G. Holmes

Part 1 of this article which dealt with poultry diseases was included in the November issue of Agriculture.

Housing and Management

SIMILAR basic concepts apply during the rearing stages of broiler and replacement pullets. In the initial planning of a new poultry unit consideration must be given to its size and position. Large groups of poultry houses should be separated by at least a mile from similar units. With multi-house sites it is

advantageous, particularly in the case of broilers, if the houses can be placed in line across the prevailing wind because this will lessen the risk of airborne disease spreading from one house to another.

Infection may be introduced to a clean site by the birds themselves, by visitors, equipment, or wild birds or it may be airborne. Wire netting will exclude wild birds and only essential visitors should be allowed on the farm. Many large enterprises supply protective clothing to be worn by visitors. This includes hats, coats and rubber boots or plastic overshoes. The hats and overshoes are disposable.

Air filtration, to reduce the amount of infection entering the house on dust particles, has been tried and found useful. It is used with a pressurized ventilation system in which fans at each end of the house draw air in through filters and pass it along a fabric tube running the full length of the house. Air diffuses through and passes out of the house at outlets along the walls. With broilers the same filters are used for two batches of birds and the fabric ventilation tubes are laundered between batches.

It has been suggested that there is an optimal size for a broiler or laying unit above which performance will suffer and disease risks increase. A broiler unit of up to 50,000 birds is recommended and a laying unit of up to 20,000 birds, with no more than 5,000 in one house. There has, however, been a recent tendency towards larger laying units with up to 30,000 birds in a single house. Although this reduces the overall cost of housing and management it has been found that the egg production is sometimes disappointing. Also it may prove difficult to obtain sufficient point of lay pullets to fill these houses without buying them from different sources. This involves mixing birds with varying degrees of immunity and increases the risk of some of the birds introducing diseases to which the others may be susceptible.

It is generally agreed that in the case of broilers it is essential to have an all-in all-out policy so that the premises undergo complete depopulation after each batch of birds has gone through. The buildings and equipment are thoroughly cleansed and disinfected. The final stage of the disinfection process should consist of fogging with a disinfectant aerosol or fumigating with formalin.

Opinions differ on the rearing of replacement pullets. Some favour an all-in all-out system as with broilers, thus reducing the opportunity for birds to be exposed to infection. In this case the birds rely on vaccination for their protection against field challenge. Others prefer a continuous production unit. This will necessitate having different ages of birds on the premises, and young replacement stock may have to be reared in close proximity to adult birds. This increases the opportunity for young birds to experience natural exposure to infectious bronchitis and so have a good immunity at point of lay, but unfortunately it also increases the risk of exposure to other diseases.

The prevention of parasitic diseases

External parasites such as fleas, lice and mites seldom present a problem under present-day methods of management. This is partly due to the efficiency of modern insecticides and also to the increasing use of batteries and an all-in all-out policy with complete depopulation and disinfection between batches. Of the internal parasites, blackhead is occasionally seen in broilers and is almost invariably associated with the use of an earth floor. Coccidiosis and roundworm infestations, however, are still common.

At first glance it may appear surprising that coccidiosis is still diagnosed so commonly despite the wide variety of drugs available for its control. It is not a single disease entity, as up to eight distinct species of coccidia may be involved, each giving a slightly different disease picture. A field infection usually involves several species, with one type predominating. Although caecal coccidiosis is now uncommon due to preventive medication, the intestinal form still regularly occurs, affecting birds from two to seven months of age. The use of continuous medication for broilers was first introduced by the Americans. It is suitable for broilers but its use prevents the development of immunity, and the birds are still fully susceptible if the coccidiostat is withdrawn.

Coccidiostats are not usually incorporated in the food of laying birds and so it is essential that they develop immunity during the rearing period. To ensure this the drug is included in the ration in diminishing amounts during the growing period and discontinued altogether when the birds are fourteen to sixteen weeks old. If an adequate immunity fails to develop, or if the challenge is too severe, they are most likely to show clinical disease at some point between sixteen weeks and point of lay. Prevention of coccidiosis should not depend entirely on the use of drugs. Clinical disease may be associated with a rapid build-up of infection as a result of faulty management such as overcrowding, or the presence of damp litter. The latter occurs especially near drinkers and can be avoided by placing the drinkers on slats. The use of slatted or wire floors reduces the risk of reinfection and also maintains a drier litter in the remainder of the house. Some outbreaks are associated with a temporary depression in food intake due to lack of trough space, high temperature or concurrent disease, when intake of coccidiostat falls below the critical level. This can also occur if the ration is diluted by grain without raising the drug content to allow for this.

Roundworms, particularly ascarids, may be controlled by dosing the birds at three months of age and again just before they are moved to their laying quarters. It is important that the birds are treated for ascarids before being housed, so as to reduce the number of worm eggs in the litter of the laying house. The eggs are very resistant and can act as a constant source of reinfection. If a heavy infestation is present when the birds are housed it may be necessary, even with battery birds, to repeat the treatment a month later. Capillaria are small slender round worms, about half an inch long, living in the upper small intestine where they are difficult to see with the naked eye. Although not so common as ascarids they reduce egg production and may kill when present in large numbers.

The piperazine preparations commonly used for the elimination of ascarids are not very effective against capillaris. On occasions when infestations with capillaria are diagnosed treatment with methyridine or Haloxon may be necessary. A new drug has recently appeared on the market for feeding continuously in the food during the rearing and laying stages. It first prevents the female worms from laying eggs and later causes the elimination of both ascaridia and capillaria.

The use of vaccines

Although good hygiene will prevent some infections from gaining access to a flock it cannot exclude them all. The economic importance of these infections may depend on the age of the birds exposed to them. Thus, the

introduction of epidemic tremor would have a serious effect on an unvaccinated laying flock causing reduced egg production and egg transmission of the virus. If the same birds had been exposed during the rearing period no clinical disease would have been apparent. Similarly infectious bronchitis has its greatest impact when it affects birds at point of lay or during the early part of the laying period. Where possible, vaccines are developed to protect against hazards of this kind but unfortunately not all bacteria and viruses are sufficiently antigenic to allow the preparation of a satisfactory vaccine against them. The result is that an owner's decision to use a particular vaccine must depend on whether the disease risk involved justifies the expense.

Epidemic tremor vaccine is used to prevent egg transmission of virus and the production of infected chicks. Laying flocks are given the inactivated vaccine at point of lay producing an immunity which should give protection for at least six months. It then relies on field infection to boost this immunity and give protection throughout the laying cycle. In recent months, however, the disease has occurred in chicks from vaccinated laying flocks, usually in the latter part of the laying cycle. It appears that vaccination has reduced the incidence of field infection so that it no longer acts as a booster; as a consequence when field challenge does occur the virus establishes itself in the flock and may be egg transmitted. This suggests that when using a dead epidemic tremor vaccine it may be necessary to revaccinate half-way through the laying period.

Newcastle disease vaccination was introduced in 1963 when the slaughter policy was discontinued. It is usually stated that to give satisfactory protection it is essential for 80 per cent of the poultry in the country to be protected. This figure was achieved and the vaccine gave very good results when used on this scale and in the recommended manner. Recently more cases of Newcastle disease have been occurring and it is noteworthy that this has coincided with a fall in vaccine uptake from 80 per cent to about 65 per cent. It seems that the former figure must be regained if protection is to be adequate. When clinical disease does occur in vaccinated flocks it is usually mild with an egg fall of up to 40 per cent occurring over a period of about ten days, followed by full recovery approximately three weeks after onset. Sometimes the disease spreads slowly, and it may then be worth while revaccinating birds even after disease has appeared in some of the houses.

Infectious bronchitis is a highly infectious disease which is similar to Newcastle disease in that it is characterized by respiratory symptoms and rapid spread to all ages of birds on the premises. It has been suggested that the virus may persist in a flock after infection, because some of the birds remain as carriers. So far there is no evidence of egg transmission although the virus has been isolated from eggs up to the eighteenth day of incubation.

The disease tends to persist on premises where depopulation is not practised, as under these conditions replacement stock becomes infected at an early age from adult birds in close proximity. Some people choose this method of exposure to replace or supplement vaccination but they run the risk of also exposing young birds to other infections such as Marek's disease. If site depopulation is practised birds may be kept free of disease during the rearing period but remain fully susceptible at the most critical period around point of lay. This type of management must be used in conjunction with a good vaccination policy.

Mycoplasma-free stock

The past twelve months have produced considerable advances in the development of mycoplasma-free broilers. It is important to remember that the term 'mycoplasma-free' means that they are free of the S.6 strain of mycoplasma gallisepticum and that the birds may not be free from other strains of mycoplasma such as that causing infectious synovitis.

There are many different methods of establishing mycoplasma-free stock. These include the blood testing of parent and grandparent stock, and the administration of anti-mycoplasma drugs in the food or drinking water or by the injection of breeding flocks. Hatching eggs may be treated by dipping or even by injecting directly into the egg. In addition the young chicks may be treated to control any egg transmitted infection. It will become important for hatcheries handling eggs from mycoplasma-free stock to avoid handling eggs from other flocks. Otherwise cross infection may occur both in hatchers and elsewhere. It also remains to be seen how mycoplasma-free stock will stand up to field exposure. Possibly a safe mycoplasma vaccine will be developed in the future as this could prove useful under certain circumstances.

Not all disease can be avoided when using modern intensive systems but given healthy stock, a satisfactory environment and an observant attendant, many unavoidable diseases can be minimized so that mortality and production losses remain at an acceptable level.

Seeking alternatives to continuous corn cropping

Ralph Whitlock

DURING the summer of 1966 the National Agricultural Advisory Service and the Agricultural Land Service in Wiltshire organized a series of visits to farms where, as they put it, 'an interesting stage in intensification and increased productivity had been reached'. The 1967 Salisbury Farming Conference attended by some 800 farmers, continued examination of the question, *Where do we go from here?*, which began at the previous summer's meeting.

Utilization of grass

In particular the conference turned its attention to the problem, common to all the lighter soils of England, of what to do with land tired of continuous corn cropping. It is becoming evident that, particularly after a series of damp, cloudy summers such as we have been experiencing, this monoculture encourages the build-up of parasites, weed infestation and disease. A return to the late Professor Sir R. G. Stapledon's ley farming system would seem to be sound policy. The subject that exercised the Salisbury farmers therefore was grassland farming—not so much the growing of grass, which is easy, but its utilization. They discussed the three main methods of transmuting grass into money, namely, feeding it to dairy cattle, beef cattle or sheep. They investigated the capital requirements for the respective enterprises in an endeavour to form some conclusions about the economics of each.

Advantages of sheep

Agreement that there was no profit in grassland not intensively stocked was general. Most speakers deplored but accepted the fact. Colonel J. Houghton Brown, who farms several thousands of acres in west Wiltshire and Wales, found that by running two ewes and their lambs, plus one-third of a beast per acre, he achieved a gross margin per acre of only £14 8*s*. Although this might have been adequate with a land rental of £1 an acre, there was a definite deficit with land rented at £6 an acre. He disposed of his cattle which, he said, always showed a loss when they had to carry their full share of fixed costs. Now, by running four ewes and their lambs per acre (his lambing average is 176 per cent) he has a gross margin of £25·7 per acre, which is very nearly that of barley-growing.

Mr. Derek Barber, County Agricultural Adviser for Gloucestershire, produced calculations based on 5 ewes to the acre, the ewes having a lambing average of 140 per cent. These gave a gross margin of £24 per acre, but the net income would be only £4. A farmer with mortgage-free land acquired at a low price might be well advised to be content with low margins rather than invest heavily in intensive ventures, but the farmer who had bought his land at £200 or £300 per acre had little choice.

Colonel Houghton Brown had found beef cattle unprofitable. Mr. Barber claimed a gross margin of £25 an acre for a cow and a calf per acre, which is a rather high stocking rate. The net income would be only just over £5 per acre. For his estimates on both sheep and beef cattle Mr. Barber reckoned on a rent of £4 an acre and on no borrowed capital at 8 per cent; otherwise a loss would have resulted. He also considered that for meat production to be anywhere near as attractive as dairying, lambs would have to make 4*s*. 4*d*. a lb when fat, and beef cattle £10 10*s*. a cwt.

Beef cattle on grass

Mr. J. H. Bailie, of the I.C.I. farm at Henley Manor, Crewkerne, Somerset, took a more optimistic view of beef cattle on grass, which he thought could give a higher gross margin per acre than either sheep or cereals. It all depended, he said, on the level of nitrogen application. At 50 units of nitrogen per acre, which enabled beef stock to run at the rate of a cow and calf to 1·7 acres, the gross margin per acre was £22·5. When the nitrogen application was increased to 250 units, the gross margin rose to £32·2 per

acre. At Jealott's Hill, Berkshire, Friesian calves used for producing 15–16 month beef have given gross margins as high as £52 an acre. The top nitrogen treatment here was 280 units per acre. At Henley Manor, Mr. Bailie stated that he achieves a gross margin of £40 per acre from a single-suckling herd of Hereford × Friesian cows mated with a Hereford bull. He considered that such a herd could profitably utilize the grass break on a cereal farm without, in many instances, materially affecting the common costs structure.

Profitability of dairying

All speakers were agreed about the greater profitability of dairying. In Mr. Barber's calculations a figure of £58 per acre gross margin was obtained. This showed a 27 per cent return on tenant's capital, as against only 5 per cent for beef and sheep. A dairy farmer, Mr. J. Miller, of Loseberry Farm, Claygate, Esher, Surrey, produced some even more impressive figures. Running nearly 100 cows on his 65-acre holding, he has achieved a gross margin of over £94 per acre. His use of nitrogen is even more lavish than those quoted by Mr. Bailie. For the past three years every acre of pasture on his farm has received 400 or more units of nitrogen. Pastures fed so generously have to be of good quality and very skilfully managed. Most of Mr. Miller's are permanent leys of S.23 perennial ryegrass, an Aberystwyth strain which responds well to heavy nitrogenous manuring and thrives under frequent treading. They are divided into two-acre paddocks, each of which is grazed by the full force of the dairy herd for two days and is then left to recover for two or three weeks. In spite of the heavy stocking, Mr. Miller contrives to make increasing quantities of silage every year. Rather unexpectedly, at this level of manuring and stocking, soiling of the pastures ceases to be a problem, and the health of the herd remains buoyant.

Apprehension was expressed at the conference concerning over-production of milk if too many farmers were convinced of its comparative profitability. Mr. Barber's answer to that was: 'Surely we must realize we are in competition with each other. The available market will be supplied by the most efficient'. Specialist dairy farmers like Mr. Miller are undoubtedly efficient, and it is with these that new dairy farmers, seeking to make economic use of their grass break, would have to compete.

Capital requirements

The conference therefore examined the capital requirements of establishing a dairy herd on a formerly arable farm. As Mr. Barber explained, there is a wide range of choice between pole barns and bunker silage on the one hand and really expensive equipment with towers and automation on the other. For his calculations he selected one of the cheaper types, putting the net cost, after deduction of grants but including both housing and equipment, at about £70 per cow. Mr. Gordon Lugg, an agricultural consultant and large farmer in his own right, examining the problem in greater detail, suggested a cost, before deduction of grants, of between £120 and £140 per cow. This was for a large, all-purpose building equipped for dairying but readily adaptable to other purposes. Mr. Lugg stressed that to meet the competitive demands of modern farming a newcomer to dairying should plan for a 100-cow dairy, managed by one man. Larger units should be in multiples of 100, and he thought that the optimum, which might be

reached in the near future, would be 1,200 cows, managed by six men milking day and night on a shift system.

Even a 100-cow dairy would require capital of between £20,000 and £30,000 to equip and stock. If this money had to be borrowed at 8 per cent., several speakers suggested that there would be little left at the end of the year for the farmer.

Making the choice

The capital requirements for beef cattle, assuming they are to be housed in winter, were put by Mr. Lugg at about £50 per beast. And those for sheep would be much smaller, though fencing and equipment can be surprisingly expensive. New grassland farmers can therefore choose between the more profitable dairying, with its high investment, and the less profitable beef or sheep farming, with much lower investment. The choice is not an easy one, and it is understandable that many arable farmers are turning to oilseed rape, field beans and other new break crops as alternatives to grass.

Market Intelligence in Western Germany

H. F. Marks

THE agricultural producer requires comprehensive, reliable and prompt information to enable him to make short, medium and long-term production and marketing decisions. The trader and processor of agricultural products needs to keep abreast of local, regional and foreign information. The farm adviser must have a good overall view of the whole situation. Perhaps even more important, the housewife requires help if she is to purchase to the greatest advantage. In *Agriculture*, July 1966, I dealt with 'Market Intelligence and Outlook Work in the United States of America'. The object of this article is to examine similar work carried out by the 'Zentrale Markt und Preisberichtstelle' (Z.M.P.), (Central Market and Price Reporting Office), Bonn. While there are many lessons to be learnt from the United States' experiences and techniques, conditions in Western Germany are in many ways more like our own. Much can, therefore, be gained from a study of the work of the Z.M.P.

Origin and aim

The aim of the Z.M.P. is to keep the domestic and foreign markets under constant surveillance and to issue market reports for all important agricultural products. Not only must short, medium and longer-term information be provided but the reports must be 'tailor made' to suit the person or organization for whom they are intended. Z.M.P. was founded in 1950 by the national agricultural organizations, for example, the farmers' unions. Most of the experts employed by Z.M.P. at its inception had worked in various departments in Berlin before the war. The work of the organization has grown steadily and is now financed by both government and various organizations with agricultural interests. There is a supervisory committee consisting of the four main agricultural organizations, the Ministry of Food and other organizations interested in the work of Z.M.P. Sales of market intelligence reports and special surveys etc., provide about 40 per cent of revenue. Approximately 40 per cent is received from various agricultural organizations and the remainder from Federal and State Governments.

Z.M.P. has a small but well qualified staff. Of the total staff of about fifty, nineteen are experienced technical workers—half are graduates and the remainder have technical diplomas. Typically their basic training is in agriculture or agricultural economics and statistics. There are seven specialized sections. Of these, five work on the 'main commodities', one deals with foreign markets and there is a strong press department. This relatively small organization is supported by teleprinters, photo-copying equipment as well as by their own printing facilities. In addition to Z.M.P.'s headquarters at Bonn, there is a branch office in Hamburg as well as smaller offices in Hanover, Stuttgart, Munich and Mainz.

Collection of data

All possible raw material is used in the compilation of reports. Some of the data on supplies and prices are collected by their own staff, but much of the information is, however, obtained from the local reporters of various organizations as well as direct from market authorities. The auction markets have a statutory obligation to compile and release information on the latest supplies and prices. The first private reports have already been collected and disseminated by Z.M.P., using teleprinters and telephones, before the official report detailing price, supply and market tendencies is published by the market authorities. This means that the first report on livestock supplies coming forward can already be issued on Monday morning. The devices employed at headquarters for obtaining information from abroad can often be surprisingly simple. A radio, a time switch and a tape recorder are all that is needed to obtain the 6.00 a.m. market report from Amsterdam.

A day spent with Z.M.P.'s Hamburg Livestock Market Reporter is an educational and interesting experience. The day begins with an early morning visit to the auction market near the Elbe. There are no farmers present as all the trading is done by agents and dealers. Information on prices is obtained by 'walking the market' and the first market report will be 'phoned to the local press before 8.30 a.m. Later, official quotations are published. Back at his office by 11 a.m., the remainder of the morning and the early part of the afternoon will be spent dictating reports to his secretary as well as dealing with other office work. There is no other staff. Towards the end of the afternoon the reporter will return to the market to obtain

details of supplies expected the next day. The Hamburg livestock market deals in cattle as well as in pigs and it is the reporter's job to keep abreast of everything that is relevant. Good reporting is very much dependent on personality and requires close and friendly contacts. A reporter must be able to speak the market's language and must not only collect information but be prepared to give information, always ensuring, of course, that there is no breach of confidence. To be effective, daily contact with the market is essential and any break due to sickness or holidays is difficult to overcome. A substitute reporter will not be able to do the job with the same effect and may, if careless, jeopardize sources of information.

Frequency of reports

As has been mentioned before, the Z.M.P. issues short, medium and long-term market intelligence. Much of the local information which becomes available almost daily is released by the branch offices direct to the press. All other reports are collated in Bonn. The frequency with which reports are issued varies for different commodities. In the case of fruit, tropical fruit and vegetables, two short-term reports are issued. One edition is published four times a week, the other twice a week. There are separate weekly reports for meat and livestock, poultry, eggs, milk, cereals and feedingstuffs as well as for potatoes; in addition a quarterly report on these commodities is published. There is also a weekly and general report highlighting the most important international background events as well as some market information. There is a monthly report on milk. Finally, there are also annual reports on meat and livestock; poultry and eggs; dairy products; cereals, feedingstuffs and potatoes; fruits, tropical fruits and vegetables. All these reports can be purchased at very reasonable subscription rates.

Contents of reports

It is impossible to detail all of the contents of the reports in a short article. In so far as the meat and livestock sector is concerned, the weekly report gives, on the first page, a summary of the main events. Both beef and pigmeat are dealt with. The summary is followed by separate, more detailed beef and pigmeat sections. The E.E.C. countries as well as Denmark, the Irish Republic and Britain are included. There are several pages of price quotations—both for live animals at the auction markets as well as wholesale meat prices at various centres in Western Germany and abroad. Usually there are two to three pages devoted to one or more special topics of interest. The weekly report is normally about ten pages in length.

The monthly meat and livestock report was recently discontinued in favour of a more comprehensive weekly report and a useful three-monthly report. The three-monthly report gives a detailed analysis of the market situation for beef and pigmeat in Western Germany, the remaining E.E.C. countries as well as the other more important Western European countries. Of great value is a forecast of pig slaughterings for twelve months ahead. There are separate forecasts in two half-yearly periods for all the individual E.E.C. and E.F.T.A. countries. The three-monthly report is normally about twenty pages in length.

The annual report draws together much of the data from the weekly and three-monthly reports and also includes some additional information. It is published three to four months after the end of the year with which it deals

and includes a very detailed statistical appendix. The 1966 report contains 83 pages of useful statistics, and not only gives a summary of various trends during the past three years but also enables the reader to discover what statistics are available for the various countries dealt with.

Interest of E.E.C. and U.K.

The fact that the E.E.C. Commission is taking an increasing interest in market intelligence as well as publishing a greater variety of improved statistics has, of course, meant that Z.M.P. is having to adapt itself to changing circumstances. There can be no doubt that Z.M.P. has, with its valuable experience, helped to guide the E.E.C. Commission as well as other E.E.C. national organizations to improve their market intelligence and outlook work. Although the E.E.C. Commission may play an increasing role in publishing statistical information, Z.M.P.'s function as a disseminator of short-run intelligence is unlikely to change. The analysis and interpretation of events is also likely to become even more significant.

Market intelligence and outlook work are also becoming of increasing importance in Britain. This is likely to continue if we remain outside the Common Market but will be even more important if we join. A free market economy and a free trade area of about 280 million inhabitants will mean that all producers, traders and processors of agricultural products will have to take an increasingly active interest in market trends. The work and organization of Z.M.P. provides a good example of what can be done with limited financial resources.

This article has been contributed by **H. F. Marks, M.Sc. (Econ.),** who is Head of the Economics Department of the Pig Industry Development Authority.

Tax in perspective

Some Advantages and Disadvantages of Trading as a Company

G. H. Camamile and E. S. Carter

ONE question which has been very thoroughly discussed since the introduction of the 1965 Finance Act has been whether, or at what point, it is advantageous to conduct a business through the medium of a limited company.

The important thing to remember is that the circumstances of each case will be different and the importance of each of the considerations will vary

from one business or one family group to another. No decisions can or should be taken without full advice from those professional people whose experience of the family and the business is likely to qualify them best to give guidance in the decision, which must involve balancing a variety of factors, many of which cannot be precisely measured.

The most important advantage of incorporation is usually that of limited liability. Although in the past many companies have been formed for the purpose of reducing the burden of taxation, the effect of the new corporation tax legislation is to give advantages only to those companies which retain profits for expansion. The express intention of the new system was to put a premium on economic growth.

Distributions, including capital dividends, made by companies now bear tax at the standard rate of income tax under Schedule F. The definition of distributions is more extended for close companies than for other companies, and if such a company makes an advance to a shareholder or connected person, the company has to account for tax at the standard rate of income tax on the 'grossed up' amount of the loan. This is only a temporary penalty, because tax can be reclaimed on repayment of such a loan, but the point should now be borne in mind.

The restrictions on directors' remuneration were discussed in an earlier article and remuneration in excess of these limits will suffer income tax as earned income of the recipient, but will not be deducted in calculating the company's liability to corporation tax.

Capital gains

If profits are retained in a company the increase in net assets will be reflected in an increased value attaching to the company's shares. If, therefore, at some time those shares change hands or there is a 'deemed disposal' as on the death of a shareholder, or a gift, this increase in value will be subjected to capital gains tax, but, of course, there are the reliefs for gains on a death or on a transfer of shares in a family company by a man aged over 60.

If a company owns an asset, like land, which may appreciate in value, any gain on a future disposal of that land by the company, without replacing it with an asset of the same class under the replacement of business assets provision, will be charged to corporation tax. The charge to capital gains tax is not, however, retrospective, and there are the important reliefs already mentioned. The taxpaper is, therefore, in a position to take into account all these factors when he makes his decision and he will often do best in the long run if he is guided by commercial considerations rather than apparent advantages in taxation for one reason or another.

For, notwithstanding the problems, there are many cases where the small company, whether limited or unlimited, will be the best means for holding and conducting a family business if only because of the ease with which shares in the business can be placed with different members of the family and, perhaps also, because of other sources of income in the family group. So far as access to money is concerned the sole trader or the partnership is at an advantage. He can pay into or draw back from his business any of the funds it needs, or he needs, without fiscal restrictions. So far as flexibility of ownership is concerned, on the other hand, the advantage is perhaps with the company.

6. Cambridgeshire (Ely District)

T. Worthington

MENTION of Ely has two associations in most people's minds—the Cathedral and Hereward the Wake. Those who have visited this area will probably add as a third impression the flatness of the surrounding landscape.

To work in the area is to be constantly reminded of these three things. The Cathedral, with the unique silhouette afforded by the Octagon Lantern, dominates the landscape for many miles around, particularly when the sun is reflected from its white leaded roof. The rivers, streams and meres that protected Hereward when he defended the Isle against William the Conqueror are being continually revealed by the plough as the peat wastes away. On many fields are silt ridges which are the remains of these rivers, and which are usually between one and three feet above the surrounding peat. The fact that these are called 'hills' and used as landmarks to describe the fields, emphasizes the flatness.

Ely itself is built on a hill about 80 feet above sea level. Like most of the hills in the area it is of Kimmeridge Clay. It is the main town of the Cambridgeshire Fens to the east side of the Bedford Level. It is a decidedly agricultural town, two of its three main industries being the construction of sugar beet harvesters and agricultural sprayers. In addition, at Queen Adelaide, two miles from the town at the bottom of the hill beside the Ely Ouse, is the British Sugar Corporation beet factory which serves the area.

The clay hills, which usually have the villages of the area built on them, provide welcome contrast and relief to the flat, black fens around them. There is little of aesthetic quality on the fens. The beauty that is seen is usually in relation to the vast expanse of sky afforded by the flatness—skyscapes, sunsets and silhouettes. But while few visitors (though there are some) would remember it as an area of scenic beauty, they will usually envy the productivity of the soil. Carrots, parsnips, red beet, leeks and ware onions are all grown locally as part of normal farm rotations. There is a greater concentration of celery within a few miles of Ely than anywhere else in the country. Much of this is washed, packed, and supplied to supermarkets throughout the country by the growers themselves.

Pickling onions too are something of a speciality in the area, and root chicory for coffee flavouring is also grown for processing factories at St. Ives and Lakenheath. Large acreages of potatoes and sugar beet complete the root cropping picture and make for a rotation in which cereals are the break crop. As far as cereals are concerned, the fens are still a stronghold of two old varieties of wheat, Hybrid 46 and Koga II, both grown for their standing power and tolerance of manganese deficiency.

The fen farm has traditionally been one with a wide range of root crops and a high labour force. One of the main causes of this was the fact that weeds grow so fast on the black soil—some say that the soil itself is fifty per cent weed seeds. To keep them down in sugar beet and potatoes, a lot of hand labour was needed. To employ this labour profitably at other times of the year, small acreages of horticultural crops were grown. So a very mixed farm with one man for every 40 or 50 acres was common. As the soils become heavier in many areas due to wastage of the peat, weeds are no longer the big problem. The soil is not so suitable for horticultural cropping so farming generally is becoming simplified.

One farm that still has a wide range of cropping is that of Mr. Claude Starling of Primrose Hill, Pymoor. Primrose Hill is an outcrop of clay, 8 feet above sea level, a few hundred yards from the bank of the New Bedford River which was built by Vermuyden in the seventeenth century as part of the major flood protection scheme instigated by the Duke of Bedford. Mr. Starling's father came a few miles from Norfolk to a neighbouring farm in 1908, and was soon recognized as a pioneer in the area. This can be illustrated by the fact that for several years nearly half of the farm grew potatoes, with good yields being obtained, showing that few potatoes had been grown here before. In 1921 beet was grown for the first time, being dug by hand, put into sacks and loaded into trucks at the nearby railway siding. Mustard for seed and carrots grown 'in halves' were the other main crops. (The farmer supplies and ploughs the land, the carrot merchant grows the crop at his own expense, and the profit is shared equally.)

At this time there was still a good depth of peat, phosphate was the only fertilizer used, and many crops suffered from potassium, copper and manganese deficiencies. It was found that claying could partly, if not entirely, cure these deficiencies, and much of the area was clayed from hand-dug trenches during the winter. Mr. Starling's grandfather maintained that if a man had no money and had to borrow to pay for claying, he should do so, the response was so worth while.

The first glass chitting house in the area was built on the farm in 1926, and this is still used and in fairly good repair to this day. Three or four years later during the depression, 90 acres of potatoes yielded 1,000 tons, but the total sales for the year only amounted to £750. Five tons of potatoes were given for a local whist drive prize on condition that the winner collected them. He did, and fed them to his pigs.

In 1937, a year after his father died, Mr. Starling bought the 100-acre Primrose Hill farm where he has since lived. Subsequent purchases have brought the total acreage up to nearly 700. Present cropping is based on a five-year rotation with potatoes and beet the main crops. Sixty acres of peas are four-poled and threshed for canning, and small acreages of celery, onions, parsnips, carrots and cole seed make up the rest of the break crops, the balance being cereals.

Mr. Starling thinks that in future his cropping will be simplified as wastage of the peat continues and the soil becomes unsuitable for the horticultural crops, and tile drainage of the whole farm will be necessary in the next twenty years.

This outlook applies to the great proportion of the organic soils around Ely, and the next few years will see many changes, not least the social structure of the area. Simplification of farming systems will come at last to one of the strongholds of intensive cropping and high labour requirements.

The Calf Nook System

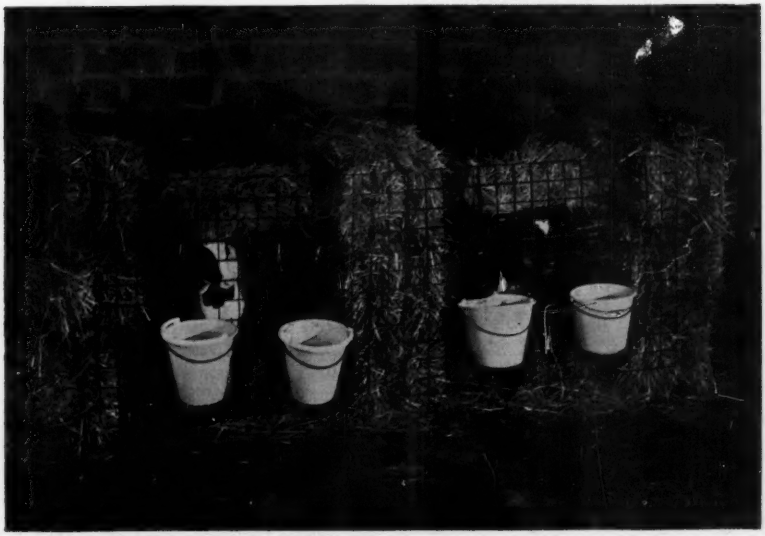
R. R. Menneer *Agricultural Land Service, Cardiff*

SIMPLE solutions to problems are often the best. In the calf nook system of calf rearing a combination of simplicity and long-term planning has resulted in a low cost and practical method which can be used on any farm where covered space and straw bales are available.

The temporary pens are arranged in series along the inside wall of any well-ventilated cattle pen or covered area. The pens are used as ordinary single-calf pens up to weaning age. Then the front and wall fastenings for the bales can be removed and the calves allowed the freedom of the whole cattle pen or shed. The straw bales need not be wasted, as they can be used for bedding within the shed. The space formerly taken up by the straw bales and the feeding passage between the pen rows will allow the calves sufficient space to grow into 10 cwt (508 Kg) beasts within the same enclosure.

This type of housing offers a number of advantages over other systems. First, it can be accommodated in almost any type of farm building and the space required need only be committed to calves during the time they are kept there. Moreover, it is not necessary to move the calves from the time they suckle until the time no further housing is required.

An example of the Calf Nook system in use



Respiratory troubles in calves can occur all too soon where ventilation is poor or the accommodation is not draught free. While, of course, it is necessary under this system to provide plenty of fresh air, the straw bales themselves will act to even out daily variations in temperature and humidity and also shelter the calves from draughts.

Under the system, cross infection of calves is virtually eliminated because no liquid or scours can pass under the pen walls. Disinfection of pens is unnecessary as the animals grow on within the same building. The steel pen fittings must, however, be disinfected but this can be easily arranged.

Manure disposal arrangements are not complicated as the internal structure of the housing does not impede the mechanical handling of litter.

Finally, the system presents no problem in catering for the individual needs of those calves which wean earlier than others and those with variable food intakes. They are not deprived of the company of other calves, which they like to have but the use of individual pens eliminates the problem of cross-suckling and bullying.

Construction of the pens is simple and unlikely to present any problem. The fastening system for the bales is made up of one steel rod 3 ft 6 in. (1·066m) long thrust vertically downwards through the rear triple layer of bales, and two steel rods each 8 ft (2·438m) long with ends bent at right angles 18 in. (457 mm) each end for diagonally cross-tying one bale wall with the next.

The pen front is made up of a section of 3 × 3 in. (76 × 76 mm) 5 gauge welded steel mesh 4 ft (1·219 m) wide by 3 ft (914 mm) high, with two 9 in. (229 mm) square holes cut out for the calf to poke its head through for feeding from the plastic buckets. One bucket for meal (or gruel at feeding time) and another for water, are inserted into steel straps, hoop shaped, on the front of the pens. A small mesh hayrack is hinged into the pen. The pen front is tied to the layers of straw bales on each side of the openings, and to the top of the 3 ft 6 in. (1·066m) rod, with baler twine.

in brief

- **Wales in transition**
- **The diminishing acres**
- **Beans into beef**

Wales in transition

TENNYSON'S reflection that 'the old order changeth, yielding place to new' is nowhere seen more appositely than in Wales at the present time. The White Paper, *Wales: The Way Ahead**, issued by the Welsh Office, examines in detail the problems that beset the economy of the Principality and the possibilities that the future holds for greater productivity by re-orientating Welsh manpower.

For the past two hundred years the coal mines have been the treasure house of Wales, but the changes already apparent largely point away from the old basic industries to new fields of enterprise—chemicals, synthetic fibres, oil refining, aircraft, motor vehicles, electrical engineering and electronics.

The future of farming in Wales is seen as one of increasing output from a smaller labour force. It can, says the White Paper, make its best contribution to national economic growth through a selective expansion programme, in which meat production is particularly important; and three-quarters of the receipts from Welsh agriculture, totalling £100–125 million a year, is earned by livestock. Between 1964 and 1966 the cattle population rose by 10 per cent to 1¼ million, and sheep numbers increased by about 8 per cent to over 6¼ million.

There are, however, too many small farms in Wales which by reason of meagre acreages, indifferent land or lack of capital, are incapable of surviving mounting competitive pressure. A large number of farmers can never hope to make a satisfactory living, and indeed in some years the net income from many Welsh farms may be less than the wages of a farm worker. By 1970, it is estimated that some 2,700 small farms will have disappeared as separate units and 4,500—5,000 full-time workers (including farmers) will have left the industry, with the intention of their re-deployment within the rural areas themselves. It is foreseen as being particularly important that in the wealth of national beauty and amenity with which Wales is endowed, tourism will be built up and the population and economy of the country towns stimulated.

Government policy is firmly directed to increasing the number of farms capable of supporting a commercial business, whilst continuing to help progressive small farmers to become more competitive. The new incentives for co-operation and worthwhile amalgamations provided under the 1967 Agriculture Act should be of special value in improving the structure of Welsh agriculture, as will also be putting hill stock subsidies on a long-term basis and the establishment of the Meat and Livestock Commission to improve production, marketing and distribution of livestock and meat in Great Britain.

A new chapter is opening in the history of Wales, and whilst this White Paper looks ahead as far as is practicable in all fields of the economy, it does not, as it says, 'attempt to predict the future'. It is a first step in what must be a continuous process of planning.

The diminishing acres

Loss of the British countryside to the inexorable encroachment of urban growth was the subject of Professor G. P. Wibberley's thought-provoking Bledisloe lecture at the Royal Agricultural College, Cirencester, this year. In 1900 only about two million acres were being used for urban purposes: by 1960 this area had been doubled. At an estimated rate of increase of 500,000 acres each ten years, England and Wales is likely to have about six million urbanized acres by the year 2000—16 per cent of the land surface. But, said Professor Wibberley, the interesting thing about urban growth is its situation rather than its extent. He pointed to the disparity between regions and especially to the high figure of urban development in the South-East.

'To be realistic', he said, 'we must anticipate a period of great discrepancies in urbanization, with the North-West, Midlands and the South-East becoming very metropolitan in character, whilst parts of the South-West, Wales, the North and even the East will still be strongly rural at the close of this century.'

Professor Wibberley also looked at the recreational potential of the countryside, which clearly should not run counter to farming interests. 'Our own estimate at Wye', he said, 'is that about three million acres in England and Wales is available, and of this nearly one-half is located in the hills and uplands.'

*Cmnd. 3334. H.M. Stationery Office, price 13*s.* 6*d.*

As regards the agriculture sector of the country's economy, Professor Wibberley's general conclusion is 'that for some years to come British agriculture will be required to use a somewhat smaller area of land than it would like to use, and that mounting land pressures will force a slight but unwanted intensification on the industry from outside.'

Beans into beef

The use of *whole* beans in a home-mixed concentrate ration for beef animals has been the subject of more than 18 months' experiment at Throws Experimental Husbandry Farm, Great Dunmow, Essex, run by RHM Agricultural Industries. The ration is composed of 2 cwt whole beans, 15 cwt rolled barley and 3 cwt urea-based protein supplement to provide the necessary levels of minerals, vitamins, etc. As with all feed systems where urea is incorporated, at least 5–6 lb per head per day of barley straw or medium quality hay must of course be used. At levels above 2 cwt of beans per ton of finished ration, it was found that whole beans were being voided in the dung. It is stressed that the beans should be fully mature and of 16 per cent moisture.

Why *whole* beans, and not kibbled or ground, as is normally advised? The answer, said Mr. Phillip Hayward, who is the crop husbandry adviser to RHM, lies in the difficulty many farmers may experience in processing the crop, the saving either of expensive machinery or a slow output from existing machinery; and with grinding there is always the risk of the stored meal going rancid.

Friesian and Friesian-type calves at Great Dunmow fed with this ration from 12 weeks to slaughter at 900 lb on a limited intake rising to a maximum of 16 lb per head per day plus straw, made overall daily liveweight gains of 2·25 to 2·5 lb.

'What we have tried to do', said Mr. Hayward, 'is to develop an inexpensive yet effective ration for beef animals that makes good use of home-grown beans without imposing undue difficulties on the small farmer.'

Agric.

The Ministry's Publications

Since the list published in the November, 1967, issue of *Agriculture* (p. 539) the following publications have been issued:

MAJOR PUBLICATIONS

Bulletin No. 151. A Manual of Carnation Production (Revised) 12*s.* 6*d.* (by post 13*s.* 3*d.*)
Aspects of Dairy Economics, 1962/1965 (New) 6*s.* (by post 6*s.* 6*d.*)
Costs and Efficiency in Milk Production 1965/66 (New) 5*s.* 9*d.* (by post 6*s.* 3*d.*)

FREE ISSUES

ADVISORY LEAFLETS

No. 11. Winter Moths (Revised)
No. 395. Hay. Growing the Crop (Revised)
No. 444. Magnesium Lime and Magnesium Limestone

SHORT TERM LEAFLETS

No. 69. Weed Control in Nursery Stock Production (New)
No. 70. Acidified Boiling Water Cleaning of Pipeline Milking Plants (New)

The priced publications are obtainable from Government Bookshops (addresses on p. 604) or through any bookseller. Unpriced items are obtainable only from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex.

Books

The Potato—a Practical and Scientific Guide. A. E. Cox. Collingridge, 1967. 63*s*.

Written by a Crop Husbandry Adviser of the N.A.A.S., this comprehensive guide to potato production is a most useful reference book for growers and also for students at the agricultural colleges. It is packed with information but it has some limitations.

The first chapter gives a description of the potato plant and its development which sets the scene for the later consideration of techniques of production. Following this, the treatment of varieties, extending to eighteen pages, includes a description of the main varieties in current use in Britain with snippets of information on the history of some of them. Several varieties rarely grown nowadays and which are no longer recommended are also described and several of the varieties recommended by the N.I.A.B. in the 1967 leaflet are not described. The brief account of the methods of varietal identification is too scanty for the crop inspector and means very little to the beginner without the assistance of illustrations.

The production and treatment of the crop from seedbed preparation to storage and grading is discussed and then one third of the book is devoted to a description of diseases, allied conditions and pests. There are some excellent plates illustrating many of these troubles and the grower is advised of any measures which may be taken to control them. A chapter on the economics of potato production explains the derivation of gross margins, where potatoes prove very attractive, and considers the economics and justification of chitting seed, spraying against blight, irrigation, indoor storage, the use of home-grown seed and the mechanization of planting and harvesting. The final chapter, relating to production, gives an account of the seed potato certification schemes and methods of seed production and then re-emphasizes certain points in the production of early and main ware crops by reference back to the previous pages. The little fresh knowledge which is contained in the later part of this chapter would have been better placed in the appropriate sections earlier in the book, so avoiding the repetition of information on varieties and techniques of production. Three times we are told that Epicure is very popular in Scotland and on at least six occasions the reader is reminded that King Edward is very susceptible to blight—but he is also given a great many other facts.

J.D.I.

A Bibliography of Farm Buildings Research. Supplement for 1965. Agricultural Research Council, 1967. 18*s*.

Between 1959 and 1961 the A.R.C. issued a bibliography of research publications on farm buildings which had appeared between 1st January, 1945 and 30th April, 1958. This was brought up to date by supplements to the 31st December, 1964.

The bibliography and its supplements appeared in sections relating to buildings for particular enterprises. This latest supplement marks a departure from previous practice. It deals with buildings of all types and contains publications which appeared in 1965. Past omissions have also been included.

The supplement is so arranged that work relating to different classes of livestock and crops is grouped together, though without any indicated break between groups.

There are 645 works reported. That is a sizeable total for mainly one year's work. Critics who frequently and loudly claim that nothing is being done in farm buildings research could usefully study this supplement and reflect on the figure quoted.

As in past works the bibliography does not set out to advise on building construction. Instead it quite properly confines itself to recording work aimed at discovering the requirements a building must fulfil to meet optimum requirements or an acceptable range of conditions as the case may be. It also records defects of buildings and environment which adversely affect performance of livestock.

To attempt even a brief summary is not practical but a random selection of items will demonstrate the worth of this work.

Lagoons are reported upon, with varying degrees of success and failure. Creosote painted on to wooden fittings in a piggery was blamed for a 28½ per cent death-rate; substitution of unpainted wood was the cure adopted. One American report suggested watering and manure removal in piggeries should be mechanized before feeding was so treated. Milking cows do not relish either extreme heat or cold, 40°F to 65°F is the temperature range they like best.

Surprisingly, 75 per cent of cows were milked in sheds in 1965. This is even more startling when viewed against performance. The average number of cows milked per worker was forty-three in herringbones, thirty-nine in parlours and sixtee. .n cow-sheds. Scope for dramatic productivity increases there!

This supplement is a worthy newcomer to a valuable and continuing work.

C.R.

The Economics of Agricultural Development. JOHN W. MELLOR. Oxford University Press, 1967. 80*s*.

Professor Mellor is, of course, well known for his brilliant articles on the problems of agricultural development. His book, which seeks to deal comprehensively with agrarian progress in developing countries, is a most welcome addition to the literature. It will certainly bring enlightenment to all economists, agriculturists and administrators who are striving to improve the lot of the farmer. As the author points out, because of a lag in the recognition of the key role of agriculture, knowledge concerning the agricultural sector is even less well developed than that concerning other sectors of the economy. We have at best only the bare skeleton of a theory of agricultural development and little systematically developed empirical knowledge of the workings of the agricultural sector in low-income countries. This lack has made it difficult to plan for agricultural development and explains much of the general dissatisfaction concerning agricultural development programmes. Under such circumstances it becomes particularly important that the creation and systematization of knowledge of agriculture be given a high priority. This places a special importance on experimental study of the existing situation in agriculture and continued and careful study of the effect of various development policies.

The book is in three parts. Part I deals with the role of agriculture in economic development. It discusses the factors affecting the rate of economic transformation, food supplies, nutrition and population growth. It also contains a very good discussion on the demand for food as growth occurs and incomes rise. It underlines the fact that for development to proceed an increase in food supplies is a strategic need given the high income elasticity of demand for food in low-income countries. There follows a consideration of agriculture as a source of capital for development, derived either by domestic saving or by taxation, and as a contributor, by import replacement and the export of cash crops, to a country's foreign exchange.

Part II considers the nature of traditional agriculture. Here, the characteristics of the four factors of production—land, labour, capital and enterprise—are considered at length. It is assumed, for example, that an increased supply of labour can achieve increased output, both within a given technology and by promoting a technological change. Consideration is given to ways of eliciting an increased supply of farm labour to achieve these ends. There follows a discussion of land settlement with its associated capital costs and a thorough evaluation of farm price instability and the response of farmers to price changes for their products.

Part III deals with the factors which bear on the raising of productivity and output of agriculture, including land tenure and reform, agricultural research, needs and sources of credit, marketing, education, farm size and agricultural planning procedures.

A book covering such a wide range of topics is naturally open to the criticism of uneven treatment and this one is no exception. The treatment of such topics as tenure, marketing, credit, etc., though thorough, tends to be superficial. On the other hand, those topics to which the author has made an important contribution, such as the role of agriculture in economic development and the sources of agricultural transformation, are excellent.

I think it is the best available book in its field.

E.S.C.

Comprehensive Russian-English Agricultural Dictionary. Compiled by B. N. USSOVSKY. Pergamon Press, 1967. £8.

The agricultural literature of the U.S.S.R. is of increasing interest and importance. Equally much of the agricultural research published in other eastern European countries is only readily available to many workers as Russian abstracts. Russian is becoming an increasingly popular alternative to English as an international language in many parts of the world and the appearance of this dictionary, albeit expensive, is an enormous help in removing some of the barriers of language.

The volume contains some 40,000 words covering agriculture in its broadest sense, including such related subjects as forestry,

land surveying, fish farming, veterinary matters, hunting and so on.

Botanical and zoological names are given with their Latin equivalents. Chemical terms, pesticides, fertilizers and veterinary preparations are given their empirical formulae. A list of common abbreviations of terms in Russian agricultural and biological literature is a welcome inclusion.

These details go a long way to make up for the presence of too many misprints and inaccuracies, and of some rather strange English equivalents. Really unnecessary inclusions are few, but there are many important omissions. The virtual absence of the terminology of farm management, farm buildings and economics is much to be regretted.

Nevertheless to anyone concerned with the study of Soviet agriculture, this dictionary will be invaluable and one looks forward to the publication here of its English-Russian companion.

L.M.P.

The Agrarian History of England and Wales. Vol. IV. 1500-1640. Edited by H. P. R. FINBERG AND JOAN THIRSK. Cambridge University Press, 1967. £7.

In 1956, a committee of scholars planned a complete social and economic history of rural England and Wales from neolithic times to the present century. It was an ambitious project and few of those responsible 'harboured any illusions about the magnitude of their task'. This volume, the first of the seven which will ultimately constitute the series, justifies their hopes and their labours. It shows that in the years to come, if present promise is fulfilled, the history of our countryside and those who lived and worked in it will, for the first time, be available in a comprehensive and authoritative work of Actonian scope and depth.

The present volume takes 900 pages of text, twenty-four photographs and over fifty figures to cover two lifetimes of rural history. It begins, very properly, with an account of the farming regions of England and Wales and the agricultural techniques of the time, continues with a description of lay and ecclesiastical landlords, farmers and labourers, and ends with chapters on marketing, prices, profits and rents, and on rural housing. Any history of this type and scale is necessarily a co-operative effort and the list of contributors reflects the variety of disciplines and interests it requires. Dr. Joan Thirsk, the economic historian who edits this volume, includes among her colleagues specialists in local history, historical geography, archaeology and, significantly, a member of a Business Research Unit. The forty pages of figures which give average agricultural prices, commodity by commodity and year by year, from 1450 to 1649, provide an invaluable background to the developments discussed in the text.

Physically, the book is not too easy to read. Economics have unfortunately made it necessary to use rather small print and rather large paragraphs. Editorially, no skill can wholly overcome the weaknesses inherent in any collection of chapters by different specialists on different themes. Neither does the technical side of farming receive quite as much attention as the modern agricultural reader would like. For example, no attempt is made to extract agricultural lessons from the instructive and well-documented story of the Pilgrim Fathers and there is no mention of Agas or Croppenburgh, whose careers and achievements typified the managerial and technical skills which developed so prophetically in this period. But these are minor comments on a major work which tells the story of Tudor and early Stuart farming in a documented detail never before attempted.

The main impression of this orderly mass of historical evidence is one of variety and contrast. It covers mediaeval survivals and the appearance of more modern assumptions and policies; the differing economies and social systems of the highland and the lowland zones; the doomed monastic landlords and 'the perdurable gentry'; the open field villages under 'the stark, but not wholly unwelcome, authority of manorial custom' and the lawless communities of heath and forest; the prosperity of the more substantial peasants which so impressed foreign visitors and the constant visitations of death and famine. It tells of Sir Thomas Ingram founding a landed family by ruthless exploitation of advantages which came his way from political patrons, while Squire Heyman defended the rights of two labourers in his village at his own cost. And behind all this diversity lay the ceaseless changes of the farming year. It takes Mr. Everitt a dozen lines even to list the seasonal chores on Nicholas Toke's farm in Kent and another half-dozen to list the kind of tools they used.

It will be a very long time indeed before this book and the mass of references it contains is superseded as the basic standard work on this period. And when that remote time comes, its successor will stand on the foundations it has created.

N.H.

Bantams for Everyone. H. EASOM SMITH. Iliffe Books, 1967. 25*s*.

To the many thousands who keep bantams this book will be a standard work of reference. All aspects of bantam keeping are covered from day-to-day management to preparation for showing.

Few flocks of bantams are kept on a purely commercial scale, most are kept as a hobby or even as pets, and much of the advice offered in the book has this point in mind. *Bantams for Everyone* is for the person who appreciates what the author refers to as the 'simpler, lovelier things of life'. The advice is practical and down-to-earth. Housing recommendations are obviously for the handyman, and some useful hints on feeding are given, e.g., the feeding of cat food containing fish and fish oils as a means of bringing the bantam into prime show condition. This may sound absurd to the modern poultryman, but to the enthusiast whose objective is individual excellence, it is sound advice.

The chapters on breeding are fairly comprehensive, but perhaps the inclusion of a table showing dominant and recessive genes controlling feather colour and marking would have made easier reading.

A large part of the book describes breeds of bantams and mentions interesting historic comments which are not normally found in descriptions of breed standards. This part of the book is well illustrated, but it is unfortunate that more colour plates could not have been used. As the author says in the preface, bantams are things of beauty, and black-and-white plates do not do them justice.

Mr. Easom Smith concludes with an A.B.C. of common terms and ailments. Quite rightly he makes no attempt to go into detail on disease, but confines his comments to mechanical disorders and, where appropriate, mentions the possible involvement of disease.

The book is easy to read and should have great appeal to both the beginner and the experienced breeder of bantams.

M.M.

Breeding for Milk Production in Tropical Cattle. P. MAHADEVAN. (Technical Communication No. 17 of the Commonwealth Bureau of Animal Breeding and Genetics.) Commonwealth Agricultural Bureaux, 1966. 30*s*.

Professor Mahadevan's book replaces a previous one on the subject and is designed to assist livestock breeders in tropical areas with problems of breeding for productivity. The scope for improvement in the industry is shown by the present position in India, where there are twenty-two cows per hundred people: if all the milk produced were consumed in liquid form the cattle could provide only about 5¼ oz of milk per human per day. In Europe consumption is 30–40 oz and it rises to 60 oz in Australia and New Zealand.

The genetic aspects of dairy cattle breeding are simply and clearly explained and the chapters dealing with the inheritance of economic characters, selection and progeny testing could, with advantage, be read by many in this country.

In the critical review of published research work the author compares European, Tropical and Tropical x European cattle in all aspects associated with milk production. He states that one of the chief reasons for the uneconomic nature of dairying in the tropics is the late age of first calving of all animals. Improvement in this character would mean both a decrease in the unproductive period of the cow's life and a quicker and more reliable progeny testing system. But unless there is an improvement in husbandry no progress will be made irrespective of the breeding methods employed. The author criticizes some of the published research for reporting only selected information and also for some of the methods used for recording milk yield.

The author concludes that there is no common improvement formula available; a realistic approach to dairy cattle improvement in the tropics must adopt different methods to those successful in temperate zones. The introduction of exotic genes is rapid but the results of crossing studies suggest that it is not the panacea for milk production problems. A place exists for improved indigenous breeds, for exotic cattle and various degrees of crossing between them for specific environments.

The book is well written, has a comprehensive list of references and is printed to the usual high standard expected in Commonwealth Agricultural Bureaux publications. There is an error on page 111; the minimum qualifying period for the lactation average of 100 days has not been put into effect by the Milk Marketing Board in England and Wales due to pressures from outside.

The author has in the main achieved his aims although, in my view, the book will be of more use to advisers and those concerned in organizing breeding improvement than to many practical herd owners.

F.K.D.

Pest Management. B. P. BEIRNE. Leonard Hill Books, 1967. 30*s*.

Pest Management is essentially a series of essays each defining and discussing the subject of the chapter heading. The chapters are as follows: Pests, Controls, Protection, Practices, People and finally Prospects.

Dr. Beirne gives as his reason for writing the book that a systematic study of this kind provokes discussion thereby leading eventually to action. The action he desires is a rational approach to pest control integrating chemical, biological, metarchonistic and ecological control to replace the largely chemical methods in use at the present time. This is a laudable aim and it is to be hoped that there will be increasing rationalization along these lines in the future. Unfortunately, this book is unlikely to stimulate the discussion that will lead to such action. The definitions are carried to such lengths that one wonders when the actual substance of the book is going to be forthcoming. However, if one perseveres, the last two chapters contain an interesting theme on the desirability for both 'integrated' specialists and integrated pest control. That there is a need for training courses for broadly-based experts rather than specialists in narrow disciplines such as plant pathology, entomology or agronomy, there is little doubt, though Dr. Beirne's thesis that the experts in human and animal medicine are that much farther along the road to integration than are the agricultural experts is perhaps carrying the point too far. The medical profession is concerned with but one entity—the human body and the veterinarians very few entities by comparison with the multiplicity of crops and cropping systems that face the specialists in agriculture and horticulture. There is, nevertheless, some substance in his argument that the pest control experts should look at the whole rather than at parts of the whole.

Despite Dr. Beirne's reasoning in the preface for not including references to published work in the text, it seems somewhat superfluous to refer the reader to the well-known biological abstracting journals. These are hardly a substitute for text references in a subject as wide and complex as integrated pest control.

E.A.R.

Rural Science Course Book 2. J. A. SHORNEY. Thomas Nelson and Sons, 1966. 12*s*. 6*d*.

This is a successor to the first rural science book, also by Mr. Shorney, which was reviewed in *Agriculture* in August, 1966. Like its predecessor, it is clear, concise and readable. With a limp cover and the contents attractively spread out on each of the 154 pages, it is a pleasant book to use in the classroom.

Schemes of rural studies vary from one county to another, and usually from school to school. A basically informal subject, good rural science teaching rests largely upon the interests and enthusiasm of the teacher, who can make full use of his own background and the rural environment within physical reach, or within the imagination, of his class.

For this type of work, Mr. Shorney's book could be very useful. It reads easily, explains things in reasonably simple language, and gives plenty of suggestions for work and investigations to be carried out by the students who use this book. Many schemes of work for rural studies seem like a jumble of ideas and projects. At first sight of the list of contents, this seems the same.

The book starts with seven chapters on simple biology, dealing mainly with body systems and functions. These are touched on briefly, and sensibly related firmly to the human body—which is, after all, the one that all children do and should know best. The diagrams are clear but one can question the value of the line of squares on page 35, or the fairly conventional digestive systems on page 38, which serve to confuse rather than clarify.

The middle section of the book comprises five chapters on keeping different types of livestock, all within the competence of many schools. There is a tendency to lag a little behind the times when it comes to breeds; pure breeds and not hybrids get pride of place in the poultry section and the illustration of the so-called 'pork type' pig has more historical than economic value today.

The final third of the book covers plants —grasses and other crops—pests, diseases, and insects generally. Obviously in so few pages only a very brief introduction to either crop or grassland husbandry can be given, but it is effectively concise. Some of the illustrations in the grass section are very familiar, but this is to be expected.

Finally there is a 'do-it-yourself' section—four basic questions on the work of each of the 20 chapters. This is a form of revision and provides a good ending to a useful book which should be found in all the places where active rural studies are carried out.

G.S.B.

books received

Meteorological Office Annual Report 1966. H.M. Stationery Office, 1967. 8*s.*

Outdoor Recreation Enterprises in Problem Rural Areas. Thomas L. Burton. Copies from The Secretary, Department of Agricultural Economics, Wye College, Ashford, Kent, 1967. 7*s.* 6*d.* (including postage).

An Economic Survey of the Bacon Curing Industry in Great Britain. Report No. 166. R. C. Rickard. Department of Agricultural Economics, University of Exeter, 1967. 10*s.*

Progress in Livestock Nutrition 1962-67. Copies free from the U.S. Feed Grains Council, Locomotive House, 30–34 Buckingham Gate, London, S.W.1.

The Sixth Report of the Joint Committee of the British Trust for Ornithology and the Royal Society for the Protection of Birds on Toxic Chemicals. July, 1964—December, 1966. Copies from the R.S.P.B., The Lodge, Sandy, Bedfordshire.

Farm Hazards to Game. Ely Game Advisory Station. Booklet No. 7. Copies from the Station, Fordingbridge, Hampshire. 2*s.*

An Investigation of the Carcass Quality of Lambs and Hoggets with particular reference to the Cold-Storage of Home-bred Lamb. Report No. 7. J. H. D. Prescott and C. E. Hinks. University of Newcastle upon Tyne, 1967. 15*s.*

The Farm Balance Sheet. Report No. 167. G. D. D. Davies and W. J. Dunford. University of Exeter, 1967. 5*s.*

Report of the School of Agriculture 1966–67. University of Nottingham. Copies from the Secretary, Sutton Bonington, Loughborough, Leics. 10*s.*

A Common Market for Pigs. R. C. Rickard. Copies from the Department of Agricultural Economics, University of Exeter. 7*s.* 6*d.*

The Economics of Mechanisation in Horticulture. Reprint No. 12. W. L. Hinton. Copies from School of Agriculture, University of Cambridge.

Farm Electrification Handbooks

No. 11. Pumping.

No. 12. Farm Lighting.

Copies free from The Electrical Council (EDA Division), Trafalgar Buildings, Charing Cross, London, S.W.1.

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